CUSTOMER GROWTH AND RATE REDUCTIONS—*Central Station Commercial Problems, with the regular departments for the executive and engineer*

Electrical World

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Hubbard Equipped

This photograph shows a Hubbard equipped pole on the lines of the Duquesne Light Company.

Bo-Arrow construction for the 22,000 volt circuit.

Hubbard Angle Steel Cross Arms for the 11,000 volt circuit.

Peirce Forged Steel Pins on the high tension lines, and Peirce Clamp Pins on the low tension lines to insure continuity of service.

Peirce Brackets for the telephone line.

Peirce Hinged Mast Arm to facilitate cleaning and renewal of lamp.

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Variations in Service Standards

THE Massachusetts Gas & Electric Light Commission heard testimony last week on what constitutes adequate steam reserve capacity in central station service. There is no doubt that in rebuttal, testimony absolutely at variance with the testimony given by the city's expert will be forthcoming. We refer to the case now regardless of its outcome before the commission because the spirit of the attack aims at the very foundation of the central station business. Service in the electric light and power field means service and not something approaching it. Absolute dependability and continuity are its outstanding characteristics, and preparedness for all emergencies by adequate reserve is the chief essential. That is the reason why so many industrial plants have breakdown service connections with the local lighting companies.

If central stations in large metropolitan districts rendered the character of service meted out by the railways, they never would have attained their present eminent position. Who, then, are so well qualified to pass on the amount of reserve capacity necessary in central station practice as the managers and operators themselves by whose foresight and ability the business has been built up? No central station executive wants needless equipment and certainly railway practice is no criterion of central station practice. If it were, railway companies would not be substituting central station service for their own. It is hardly to be expected that they would be giving up that which is superior for something inferior. Central station managers and engineers need not be guided by any rule stipulating the ratio between peak and reserve. They have no better guide than their own experience and they should adhere to that and not to some theoretical formula. In this it is certain they will be sustained by commissions and courts alike. It is well for them to keep ever in mind the parable of the ten virgins.

Meter Psychology

THE electric meter with its attendant periodical bill continues to be the universal point of contact between the user of electricity and the central station. The simple transactions of reading the meter and making out a bill, rise above the ordinary business transaction and become a part of the relations of the company with its public. Meter reading and billing in the abstract are questions of public policy. The electric meter is still a mystery to most customers. As a consequence this remarkably dependable piece of mechanism is an object of suspicion in many households. Much has been written on this subject, much has been done to make the customer understand the meter, but much remains to be done. In Mr. Van Wert's article in this issue practical methods of meeting the customer's views on this new-old subject are interestingly told. The care to explain how the meter works, the naming of a bureau "Adjustment" instead of "Complaint" department, the assumption that the customer is always right, all are human factors in what may be called the psychology of the meter. If a customer could visit a factory and see meters in process of manufacture, if he could take the jewels in his hands, and see the sturdy delicacy of the parts; if, in other words, he could be made to see that the meter is as near a 100 per cent truth-teller as a machine possibly can be, there would be fewer complaints. The meter and the resultant bill should constantly be considered from the broad viewpoint of public policy.

Single-Phase Motors on Lighting Circuits

A FEW years ago there was a wide variation in the rules adopted by central stations governing the installation and use of motors upon their circuits. To rectify this, the electrical apparatus committee of the National Electric Light Association took the matter under advisement and formulated a uniform set of rules. These were presented at the 1915 convention and formally adopted by the association last year. An important section of these rules deals with the regulations governing the installation of single-phase motors on lighting circuits. As is very generally known, there are two types of single-phase motors which are generally sold for operation on central station circuits—the split-phase type and the repulsion-induction type. Both types are broadly manufactured by various manufacturers of single-phase motors. The repulsion-induction motor inherently takes a smaller starting current than the split-phase motor and is usually recommended in large installations; that is, above the class covered by the small household appliances such as washing machines, small stationary vacuum cleaners, etc. Since the split-phase motor in these small sizes is a cheaper and simpler motor to use, it is to the interest of the user, the manufacturer of the driven device, the dealer selling it, the manufacturer making it and the central station supplying the service to use a motor of this kind. The rules in question provide that single-phase motors requiring not more than 30 amp. starting current may be connected to 110-volt circuits. This covers the split-phase type of motor and in this way does not handicap any individual motor manufacturer but assists in the exploitation and use of small motor-driven machines.

Having set the standard, it is incumbent upon all members of the National Electric Light Association as well as the electric lighting industry in general to abide by it. Our attention has been called to the fact that two or three of the large companies in the East still adhere to rules which are at variance with those formulated by the National Electric Light Association and which militate against the use of the split-phase motor on their lighting circuits. This is not as it should be. The manufacturers have in all things adhered to standards laid down by the American Institute of Electrical Engineers and the National Electric Light Association and having done so they have every reason to expect that their motors will be permitted on circuits for which they were intended. Any lack of co-operation, therefore, on the part of Eastern companies is to be regretted. The industry as a whole can only advance when the manufacturer, the central station company, the jobber, the dealer and the contractor work whole-heartedly hand in hand together.

Automatic High-Speed Wireless

ONE of the most effective ways of increasing the traffic capacity of any telegraph system, wire or wireless, is to substitute high-speed automatic working for hand operation. Ordinarily an automatic rapid system working at eighty words or 200 letters per minute will carry through more messages per day than will the corresponding hand-operated quadruplex, even though each pair of Morse operators reaches speeds of twenty-five words per minute. The elimination of waste time between messages, the reduction of errors and consequent saving of repeats for confirmation, and the machine-like regularity of pace all tend to increase the traffic handled by automatic apparatus. In wire operation it has been comparatively simple to reach high-transmission speeds, as in the Wheatstone system. Not a great deal of power need be controlled to form the signal characters at the sender, and ample current to operate a polarized relay or inker is usually available at the receiver. Very different conditions exist in radio-telegraphy, however. At the transmitting station it is necessary to control several kilowatts of power for even quite short distances, and when the sending range reaches thousands of miles the sending machine may signal with hundreds of kilowatts. At the receiver, too, the problem is difficult, for ordinarily the available power is only enough to give fair operation of a delicate telephone earpiece. Automatic recording by the simple process of photographing the motions of an Einthoven galvanometer string has proved unsatisfactory, largely because of the extremely large interference effects produced by atmospherics.

So far, phonographic reception seems to be the most useful plan put into use. In this type of automatic recording, the received signals are amplified until their tones are sufficiently loud to record themselves clearly upon a wax-cylinder phonograph or telegraphone. In the process of reception the phonograph is run at a speed considerably higher than normal. The records thus made are distributed among transcribing operators, who reproduce the Morse signals at normal copying speed and translate them into written English. If the high-speed signals are received at eighty words per minute on a phonograph running 300 r.p.m., the records are turned over to four transcribing operators whose reproducing phonographs run at seventy-five revolutions or twenty words per minute. This reduction of phonograph speed of course lowers the tone of the signals by two octaves. As was pointed out in a United States patent issued about a year ago, however, interfering sounds are correspondingly lowered in pitch and may even become inaudible. These methods of automatic operation are of especial interest at this time, on account of their experimental adoption in some of the large trans-Atlantic and trans-Pacific wireless telegraph stations.

Changing Lines to Suit the Load

CONDITIONS in the industrial field served by central stations are such as to lead toward larger loads and a need for a more liberal application of economic laws in transmission line extensions and changes to suit these conditions. Short lines must be extended and others remodeled, insulators substituted and voltages increased. These problems should be considered as a matter of course and their solution worked out on a basis that will not hamper the company's sales force in reaching out after lucrative business. With the larger transmission companies these modifications come naturally, special apparatus being devised in some cases whereby changes on live lines operating at 110,000 volts can be made, so imperative is it not to interrupt the service. The smaller company has a great deal to learn in this direction. Changing lines is not the bugbear that it seems. Not long ago we described a case where it was necessary not only to change from one size of insulator to another but from the pin type to the suspension type. The change to suspension units was made without interrupting service although it involved difficulties in clearances, especially as regards the ground, and necessitated increasing the height of the towers. This was done by erecting four gallows frames, tied together at the corners, around the base of the tower. At each corner a two-ton block carried its share of the total weight. The legs of the towers were cleared; the tower was steadied by solidly anchored guys provided with chain blocks for adjusting the weight, and then gradually the whole tower was lifted clear until a new section could be bolted on.

This sounds like a rather difficult job, but in point of fact it was worked off without any serious mishap and at an average cost of a little over $50 per tower for a 10-ft. extension. After the towers were thus lengthened the shifting of the line was comparatively easy, since there were two circuits on each tower and by transferring the load to one and grounding the other circuit solidly at its ends and at the tower attacked, the work was safely accomplished. The lower crossarm had to be dropped two and one-half feet on account

of the change, and for this purpose twelve new rivet holes had to be made at each tower. This was accomplished rather easily by a boiler maker's punch, set in place by men on the tower and operated from the ground. Finally a gin pole was set to shift the wires themselves, the downward pressure of which is about 400 lb. at the tower per wire. Altogether a very workmanlike job was made of the change at a cost not excessive considering the nature of the work and the difficulties of transportation encountered in some sections of the line. This is ample evidence of the flexibility of transmission line engineering nowadays more than of foolhardiness on the part of a daring line crew and foreman. It shows how common sense and carefulness are turning the impossible into entirely practical ways for systems which otherwise might be handicapped in carrying out changes necessary to the best interests of their commercial development.

Readjustment in Manufacturing Conditions

ELECTRICAL manufacturers in general have a clear understanding of the certain and uncertain elements affecting their business at the present juncture. They know that there is still an enormous unsatisfied demand, that their own costs and difficulties regarding raw materials and labor are still serious, and that a period of readjustment will confront them sooner or later. What they do not know is when readjustment will be necessary or to what extent it will be required in order that operations may be brought into alignment with the new conditions. In broad terms their position is that they have sold their output for a long time ahead and that they have prudently contracted for such raw materials as they will need within a reasonable time to meet the orders for apparatus and supplies. It has been exceedingly difficult for manufacturers to decide how far they could afford to go in protecting their requirements and how far they were justified in delaying purchases in the hope that a reaction would occur before replenishment should be unavoidable. Until conditions are more settled, this problem will remain. Those who bought and contracted to the full limit when prices were lower have, of course, every reason for satisfaction; but a declining market, when it sets in, will afford equal satisfaction to those who will then buy, so far as is possible, only from "hand to mouth."

Over-All Efficiency in Industrial Work

ELECTRICAL engineering factors form only one group in the complete problem of applying electricity in the factory. The electrical engineer and the power salesman, generally, must consider electrical applications in the factory from the broad point of view of consulting industrial management rather than from the less inclusive viewpoint of electrical engineering. A manufacturing operation must be analyzed into its component parts and the electrical applications considered with relation to the other phases of the problem, such as labor and material charges. This point was made very clear by Homer H. Kunz of the Toledo Railways & Light Company in a paper on industrial heating which he presented at the meeting of the commercial men of the Ohio Electric Light Association at Toledo. Thermal-electric efficiency in industrial heating may be quite secondary, but the electric heating may make possible an over-all efficiency for the operation which is attainable only because of the flexibility and ease of control of the electric heating elements of the installations. In some cases the thermal efficiency of the electric application may be lower than the thermal efficiency of other sources of heat, but the over-all efficiency of the operation is very much higher than that obtained in any other way.

Greater output at lower unit costs is generally the object of an overhauling of the methods in a manufacturing establishment. The power salesman must take to the manufacturer not only his knowledge of electrical engineering but a knowledge also of production engineering in which lower unit costs of output are the end to be gained. A power salesman, in order to interest a manufacturer in his product, finds his easiest approach in showing, not how efficient are his motors but how they may be applied to give a manufacturing operation greater efficiency. A complete arrangement of machines may give an over-all efficiency to a department in which electric motors for driving are only a secondary consideration. The sale is made more on the basis of production engineering than on electrical engineering alone. With the coming of electric industrial heating, the power salesman becomes a prophet for greater manufacturing efficiency. He must often break down a great deal of rule-of-thumb knowledge which will not bear engineering analysis. In this respect he applies the entering wedge to better industrial methods.

The Coming Issues

IN the first issue of next month, dated Feb. 3, will appear the second section of the article commenced in this issue describing the mechanical and electrical features of the large steam station of the Buffalo General Electric Company. Another article will recount the results of experience during eighteen months with a plan for reducing rates with the increase in number of central station customers in a large city, following the principles laid down in a leading article in the current issue. One of the leading articles of the second issue of February, which is devoted to the problems of station and operating practice, will discuss the layout, installation and performance of small engine-driven generating units. In the number dated Feb. 17, an article by Prof. Alfred Still will take up the technical and engineering problems involved in the design of high-tension terminals and bushings to meet operating requirements. The January issue of ELECTRICAL MERCHANDISING, which appeared on the 15th of this month, included among other articles an account of the methods used by a number of Boston (Mass.) dealers and contractors for renting motors and other electrical machinery.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

ATLANTIC CITY CHOSEN FOR N. E. L. A. CONVENTION

President Herbert A. Wagner Decides Upon Week Beginning May 29—Milion-Dollar Pier to Be Headquarters

It has been decided by President Herbert A. Wagner of the National Electric Light Association to hold the next annual convention of the association during the four days May 29, 30, 31 and June 1 at Atlantic City, N. J.

The reception, meetings and exhibition will be held at the Million-Dollar Pier, at which place headquarters of the association will be established. In order to overcome one of the objectionable features of past meetings at Atlantic City, namely, that of the noise of the waves, all meetings will be held on the second floor of the pier instead of the first.

STATUS OF WATER-POWER LEGISLATION IN CONGRESS

President Wilson Takes Personal Interest in Bills Now Before the Senate—House Adopts Conference Report Favoring Temporary Niagara Diversion

There has been very little consideration of the water-power bill in the Senate the past week. A good start was made last week, when the bill was made the so-called "unfinished business" of the Senate, but consideration of the measure has been frequently prevented because of discussion of the legislative, executive and judicial appropriation bill, against which there have been filibusters. In addition, the Senate will now need much additional time for the consideration of the other appropriation bills which must be passed before the present session of Congress ends on March 4. All of the appropriation bills are behind time.

President Wilson has taken a personal interest in the possible passage of the various water-power bills before Congress during the past week. He has adopted the policy of spending three days a week at his room in the Capitol building, in the hope of expediting water power and other legislation, but there is much opposition to his presence at the Capitol. Some senators and representatives have made bold to say that he is interfering with the legislative branch of the government, and may oppose bills he supports because of the methods he is employing in his attempts to urge their passage.

The President has allowed it to become known that he is strongly in favor of water-power legislation at this session of Congress. He has been at pains to resent newspaper reports that he favors any particular measure now in disagreement among Senate and House conferees. The President's efforts are being bent toward bringing the conferees together, "in a spirit of mutual accommodation," to use one of his phrases.

The temporary diversion of 4400 more cubic feet of water a second from the Niagara River at the falls until July 1 was authorized in a conference report on the Cline Niagara Falls bill, adopted by the House on Jan. 18.

The bill is designed to relieve a water power famine at Niagara Falls pending permanent legislation to regulate water power.

CENTRAL UNION SALE TO BELL SYSTEM ILLEGAL

Superior Court Holds Its Ownership of Local Telephone Stock to Be Null and Void, Censuring Monopolistic Feature of System

In the case of William Read, representing minority stockholders of the Central Union Telephone Company, versus the Central Union Telephone Company the Superior Court of Cook County handed down its decision on Jan. 20, holding that the $5,200,000 of stock of the Central Union company held by the American Telephone & Telegraph Company to be null and void. This decision is based on the Illinois law that foreign corporations operating in Illinois have only such powers as Illinois corporations and the latter cannot own stock in another company in the same business. The fundamental plan of the Bell system is held by the court to be to build an illegal monopoly and the Public Utilities Act must not be construed to sanction monopoly because of the regulatory powers given the commission. Certain accounting rights are also granted the complainant.

ANNUAL SESSION OF THE PACIFIC COAST JOBBERS

Movement for More Intensive Co-operation Between Electrical Interests Takes More Definite Form—New Officers Elected

The annual meeting of the Pacific Coast Division of the Electrical Supply Jobbers' Association was held at Del Monte, Cal., Jan. 11, 12 and 13. Under a recent regrouping plan this division now includes Salt Lake City, Butte and Spokane, and from these districts a number of new members were represented, thus making this meeting the largest ever held. Franklin Overbagh, the general secretary of the Association, and Thomas M. Debevoise, general counsel, were also present.

At the open meeting with the manufacturers, S. V. Walton, of the Pacific Gas & Electric Company, San Francisco, read a paper on "Closer Co-operation Between Central Station and Dealers" leading up to a suggestion that definite steps be taken toward a closer co-operation of the three interests involved in marketing appliances and supplies, namely, jobbers and manufacturers, central stations, and dealers. It was suggested that manufacturers might extend to the small dealer and contractor more aid in the detail of display, demonstration and sales work.

Judge Debevoise in a brief address pointed out that co-operation is of two kinds, 1—illegal and inefficient or 2—legal and efficient. In co-operation of the first kind two or more interests meet and agree, or are made to agree unwillingly, on prices. The only certain result of such agreements, he stated, is that they will not be permanent. Legal co-operation, on the other hand, consists in appealing to the intelligence of competitive

interests, educating all concerned to the point where the trade policy will be of the highest type and there will be no necessity of discussing prices. Such co-operation is permanent, he said, and of general benefit to the industry.

T. E. Bibbins, of San Francisco, suggested that perhaps the newly formed Pacific Coast Section of the N. E. L. A. offered a channel through which it would be possible to extend to the contractor and dealer the help which this class of the industry urgently needs. With this purpose in mind, there was discussion of a plan to appoint a committee from each of the three classes of interests involved to arrange closer co-operation in the marketing of electrical appliances.

At the annual banquet on the last day of the meeting strong commendation was made of the work done by W. L. Goodwin of San Francisco, in organizing Pacific Coast interests engaged in the electrical field. Mr. Goodwin was on the point of leaving to take up new work in New York. Golf trophies were presented, with appropriate comment, to the following members: F. N. Averill, Portland, T. M. Debevoise, New York, R. J. Davis, San Francisco, J. G. Morris and S. V. Walton, San Francisco.

The election of officers resulted as follows: Chairman, Samuel H. Taylor, Electric Railway and Manufacturers' Supply Company, San Francisco; secretary, Albert H. Elliott, San Francisco; and T. E. Bibbins, Pacific States Electric Company, San Francisco, was named as member of the general executive committee from the Pacific Coast Division.

INDIANA RANGE CAMPAIGN PLANS

State Association's New-Business Men's Meeting at Kokomo Devoted to Broad Topics

Muncie was the meeting place on Jan. 23, of the second convention of the new-business committee of the Indiana Electric Light Association. Short talks on business-getting methods of interest to central station commercial men were offered, and many valuable ideas were presented.

The paper by R. W. Mercer, the General Electric representative at Indianapolis, together with its discussion showed the opportunity actually before the central stations in the exploiting of the electric furnace in the steel industry and also electric heating ovens in the steel, automobile and other industries.

An interesting discussion involving merits of both Snyder and Heroult furnaces took place and it was proved that each has definite advantages in doing particular work. It was mentioned that no further development of the forge furnace may be expected until these can be imported either satisfactory refractory materials or good substitutes made in this country.

The proposed plans for the state-wide campaign on electric cooking were discussed broadly and these plans are to be referred to the central station executives for approval at once. The scheme calls for the appointment of a representative of the Society for Electrical Development to open an office in Indianapolis for a few weeks and take charge of the publicity and promotion work. Advertising will be placed in newspapers, street cars, on billboards, etc., preceded by educational articles.

The central stations are to back up the movement by holding baking contests in each town and the town winner will receive as her prize a free trip to Indianapolis. Here she will enter another baking contest against other town winners—the prizes for which will be electric ranges. The manufacturers are being asked to place particular emphasis on Indiana as a sales field during this campaign.

The ideas advanced by Thomas F. Kelly of Dayton, Ohio on "Profitable Central Station Advertising," were eagerly received. He said that the new-business man should by all means be an advertising man. Furthermore, it was pointed out that central stations should early learn to take advantage of the newspaper as their best medium for reaching their customers. The use of plenty of literature and booklets is advisable. Copy should be clear and forceful and windows should show what is for sale in an attractive manner.

The paper by J. P. Ohmer on "Wiring of Existing Buildings," brought out the following figures: In Elkhart, 1000 old houses were wired during 1915, the net gain in Muncie was 900 and in Kokomo, 1380 new customers were added to the company's lines.

It appears from the discussion that the largest number of house-wiring contracts are signed in towns where stress is placed on securing them from customers living in houses of four or five rooms and when a cheap price is quoted for cord drops with a payment plan advanced for settling the bill. This places electric light within reach of all and about 80 per cent of the new customers install fixtures anyway, thus voluntarily increasing the cost to them.

ANNUAL MEETING OF WESTERN ELECTRICAL INSPECTORS

The National Electrical Safety Code, Wiring for Induction Motors and Lamp Socket Ratings Bring Out Interesting Discussions at Toledo, Ohio

The relation of feeder sizes to connected load, field trials of the National Electrical Safety Code, wiring for squirrel-cage induction motors, and socket ratings were topics discussed from interesting viewpoints at the twelfth annual convention of the Western Association of Electrical Inspectors at Toledo, Ohio, on Jan. 23 and 24. The discussion of the first topic brought out data regarding demand factors for various classes of electricity users. H. P. Gear of Chicago maintained that inspection departments have in a great many cases been in error, when they assumed that the demands of installations at certain times equals the connected load. Data were presented sufficiently general in character to be of service as guides in selecting equipment of proper ratings.

The safety code was discussed from the viewpoint of the Bureau of Standards and the electrical inspector by W. J. Canada, Washington, D. C., and from the viewpoint of the utility company, by R. J. McClelland, New York. In a communication read by H. P. Gear, Mr. Canada expressed the opinion that all sections of the code will be easy of application and administration by existing inspection departments with the exception of the section on lines. This section, he believes, should be made the subject of special study by inspectors who will administer it. Mr. McClelland, who stated that he did not speak for the N. E. L. A. but as an individual utility man, expressed preference for a national code rather than many codes. In regard to the present safety code, while he considered some specific rules too severe, he said it is most valuable as a basis for voluntary agreements between utilities and as a guide to designing and operating central station men. To make it more valuable he suggested that the Bureau of Standards issue in pamphlet form those rules in the code which apply to such specific subjects as crossings, joint pole lines, etc. These pamphlets would be useful to companies seeking to make a joint agreement. They would also be valuable to commissions and inspection bodies who wish to adopt rules on some specific points, but do not care to adopt an entire code. In this man-

ner Mr. McClelland believed the influence of the code and the tendency toward standardization could be more rapidly broadened.

A lengthy discussion on interpretation of rules for determining what sizes of leads to use in squirrel-cage motor wiring brought no definite result. Speaking on lamp socket ratings Dana Pierce, New York, pointed out that the life of sockets is entirely fixed by the generally unintelligent use or misuse they receive at the hands of electricity consumers. He expressed the belief that some of the present troubles with sockets can be eliminated by advocating heavier sockets. The trend seems to be toward a 660-watt key socket containing a better switch. On the other hand he said the present status of the metal market and the manufacturing situation makes this a particularly inopportune time to urge upon manufacturers changes in design of standard products. At the close of this talk many inspectors expressed a real need for better sockets and on the suggestion of V. H. Towsley of Chicago, placed the association on record as recommending a 660-watt socket, without specifying the time when such a recommendation would go into effect.

VALUATION OF CLEVELAND ILLUMINATING PROPERTY

Tentative Totals of Value in the Pending Rate Case Are Made Public by the Ohio Public Utilities Commission

A tentative valuation of the property of the Cleveland Electric Illuminating Company has been announced by the Ohio Public Utilities Commission in the Cleveland rate case. The totals which are shown in the table published herewith compare roughly with a present capitalization of about $19,000,000 which, however, will probably be increased substantially by unfunded capital expenditures representing extensive improvements made by the company,

TENTATIVE VALUATION OF PROPERTY DEVOTED TO ELECTRIC SERVICE AS OF JULY 1, 1914

	Reproduction Value	Depreciation	Present Value
Land	$921,728		$921,728
Structures	2,248,972	$104,801	2,144,171
Equipment	12,696,866	1,294,939	11,401,927
Current and nominal assets	381,749	28,365	353,384
Total electric	$16,249,315	$1,428,105	$14,821,210
Less coal	27,631		27,631
Sub total	$16,221,684	$1,428,105	$14,793,579
Plus undistributed overhead charges	17,457	1,537	15,920
Total physical property	$16,239,141	$1,429,642	$14 809,499
Intangibles			
Preliminary expense	$59,808		$59,808
Omissions	153,174	$13,485	139,689
Engineering	531,781	46,816	484,965
Legal expenses	98,756		98,756
Administration expenses	185,095	16,295	168,800
Taxes 2.90 on $15,675,397.49	454,587		454,587
Financing	1,034,660		1,034,660
Interest, 12 p. c. on $18,193,258	2,183,191		2,183,191
Cost to attach business	1,112,070		1,112,070
Working capital	274,037		274,037
Total intangibles	$6,087,159	$76,596	$6,010,563
Total property used and useful in electrical operations	22,326,300	1,506,238	20,820,062
Property used in other than electric operations	1,782,550	159,765	1,622,785
Sub total	$24,108,850	$1,666,003	$22,442,847
Property not used or useful	289,344	47,650	241,694
Total	$24,398,194	$1,713,653	$22,684,541

The commission reserves the right, in the event that it shall determine the inventory to be incomplete or inaccurate, or that the valuation is incorrect, to make such changes as may be necessary before the tentative valuation shall become final.

STANDARDIZED BATTERY SERVICE RECOMMENDED

How a Universal Battery Exchange System Will Benefit Manufacturers and Facilitate Vehicle Sales

Standardized battery service was recommended by Day Baker of Boston, at the New York meeting of the electric vehicle section council, National Electric Light Association, Jan. 25, on the ground that it would permit universal application of the plan of selling electric vehicle facilities on the mileage basis regardless of the make of battery and truck. The remarks made before the council dealt in detail with recommendations made by W. H. Blood, Jr., at the time of the latter's inaugural as president of the, then, Electric Vehicle Association of America. According to reports Thomas A. Edison agrees with the general principles laid down there.

Mr. Baker pointed out that while the electric way of handling transportation appeals to the average mechanically inclined business man, more rapid progress in the use of electric vehicles will require a larger volume of educational advertising and the greater popularization of the battery-operated truck through removal of certain existing handicaps. Aside from the rather indifferent method of merchandising electric trucks, it may be said that the cause for the stagnation in the advance of the electric truck business is due to the battery, or perhaps to the reputation of the older forms of batteries which have been handed down; the limitations as to mileage and charging and the uncertainty of maintenance costs. The National Electric Light Association through the electric vehicle section should come to the rescue of the electric truck, by providing a method of overcoming the obstacles which stand in the way of its more general adoption.

A system of battery exchange will greatly popularize the electric truck, if it is possible to have battery compartments of a standard size for each capacity vehicle. The experiments which have been made with the battery exchange system have shown that the general idea is excellent and represents a desirable method of handling commercial vehicles. However, to build up the vehicle industry as a whole, and that is the only way for the association to treat the subject, it must not be developed along any but the broadest lines, and in a manner which will place the electric truck and the N. E. L. A. battery exchange system beyond the criticism of the public.

"It can readily be seen," said Mr. Baker, "that with such a battery exchange system, the makers of batteries would have a feeling of security in ordering materials, building in advance of actual orders, and even assembling batteries for the various sizes, knowing that they could be used in any make of vehicle." At present there are four methods employed for the quick exchange of batteries in electric trucks: First, that developed by the Electric Vehicle Company of Hartford, Conn., which is used by the Boston Edison company, the R. H. Macy Company of New York, and the Amoskeag Manufacturing Company of Manchester, N. H., with a few other scattered installations; second, the facilities provided by R. McAllister Lloyd; third, the facilities devised by M. L. Stone of the W. F. Stone Company, Boston; fourth, the roll-in or slide-in battery scheme which is used on a number of Couple-Gear trucks in Boston and which has been developed for battery-exchange service in Chicago.

The first two methods require for proper operation the use of one or more hydraulic lifts. With the construction employed it is impracticable to truss the frames, as is often found desirable, especially if the

weight is to be kept within desired limits. With the two latter methods no hydraulic lift nor expensive loading machine is required. The third plan is extremely simple, permits of application to any make of truck and trussing the frames, and does not necessitate the purchase of extra cradles at a cost of over $100 each for the additional batteries.

Mr. Baker disclaimed being an advocate of any special form of carrier for holding batteries, believing that if this matter is handled by the committee on standards a carrier will be adopted which will embody the greatest simplicity without weakening the chassis design. Manufacturing rights can doubtless be obtained for any of the patented devices at a price per vehicle which would add only a very small percentage to the manufacturing cost of each truck.

The desirable system of exchange of batteries carries with it the possibilities of presenting to the vehicle purchasing public a real innovation of value and interest, without any strings to retard its legal adoption or popularity. Coupled with the possibilities of presenting "Electricity by the Mile," it opens the way for a co-operative advertising campaign by the association members and the vehicle and battery makers which could not fail of results. The association now has within its power, as the real arbiter of the destiny of the electric truck, to establish battery compartment standards. These must permit the interchange of any make of battery which is constructed on lines and with characteristics approved by the association, in any of the accepted forms of storage battery road trucks.

With standardized battery cradles any central station could sell electric truck service by the mile, a method already demonstrated with some success in Hartford and Boston. This method would be sure to become popular, as it converts kilowatt-hours into terms which all vehicle users readily understand. It would give the world the possibilities of real battery exchange systems, make the electric truck popular, bring orders to all the makers of trucks and batteries, unite the electric vehicle industry, and conserve the benefits of the valuable off-peak load, which is sure to result from the proper merchandising of electric trucks and energy.

PROPOSE STATE TAX FOR CITY-OWNED UTILITIES

California Board of Equalization Recommends Equal Rating for Municipally-Owned Utilities and Private Property

In the annual report just issued by the California State Board of Equalization, the following significant recommendations are made:

"There seems to be no reason in equity why the municipally owned utility should not bear its just proportion of a State tax. If the separation law is to continue it should not be permissible for the State's political subdivisions to undermine the law by reaching in and pulling out some of the main props.

"It must be remembered that the constitutional provision under which the State is collecting its principal revenue from taxation has a provision that if at any time the revenues derived under the present system (and receipts from all other sources) prove inadequate to maintain the State government, then and in that event a general deficiency tax ad valorem shall be levied upon all of the property in the State sufficient to meet such deficiency.

"We state the proposition, therefore, that it is manifestly unfair for San Francisco and Los Angeles, or any other subdivision of the State, to take over a public utility taxed solely for State purposes without paying to the State the amount of taxes which would ordinarily accrue under private ownership. To do so creates a great liability for a deficiency in the State's revenues, and if resort is had to an ad valorem deficiency tax an unwarranted burden is cast upon the people of the State who do not live in the cities concerned.

"We recommend the enactment of a law by which the municipalities owning and operating public utilities shall be required to report to this board and pay a tax commensurate with the State's other taxpayers."

INDIANA ENGINEERS DISCUSS PUBLIC UTILITY PROBLEMS

Three-Day Session at Lafayette Devoted to Broad Topics, Among Which Were Street Lighting and Utility Regulation and Practice

Delegates to the thirty-seventh annual convention of the Indiana Engineering Society, convening at Purdue University, La Fayette, Ind., on Jan. 18, 19 and 20, were received and welcomed in an opening address by Dean Coulter of the engineering schools, after which Prof. L. W. Wallace, president of the Indiana Engineering Society, further welcomed the members in a short address, citing the great strides made in the engineering professions in the last few years. He referred to noted examples of recognition being accorded to the engineer by the nation, first in the formation of the Naval Consulting Board, and secondly in the Industrial Preparedness Survey, which was made this year.

The program opened with an address by Gen. Anson Mills, U. S. A., retired, on "Industrial Development in the Republic's Life in One Hundred and Twenty-eight Years," followed by a paper by Prof. A. N. Topping, entitled "Modern Tendencies in Street Lighting." He traced the development of the street light through its early stages to the gas-filled tungsten lamp of the present day.

He referred to the contractual relations as being a frequent cause of unsatisfactory street lighting in that they did not adequately specify the service to be furnished or the means of ascertaining whether that service is being furnished. Good contracts provide for a possibility of making changes in equipment within certain cost limitation to take advantage of the improvement and progress in the art of lighting. It was suggested by Professor Topping in his paper that the Indiana Engineering Society might very appropriately prepare a set of standards for use in Indiana towns and villages.

Samuel B. Mott, in a paper on the subject of "Street Lighting in Small Towns," showed in detail the value of street lighting in a small town from the central station company's viewpoint. Mr. Mott considered the securing of the contract as the important thing to both central station and the town. Among other elements influencing the making of a contract was mentioned the area to be served, distance between lamps, size and method of suspending lamps, the schedule whether moonlight or all night. The location of lamps and distance between them is as important a feature as the means of suspending the lights. Lights should be placed at a height of 18 ft. or 20 ft.

The first day's session closed with a report from the committee on electrical engineering and electrical railways through its chairman, Prof. D. D. Ewing. The speaker referred to the growing demand of heavy apparatus in the electrical field. The development of electric railways, he said, had somewhat abated, due to the high cost of materials.

On Friday morning E. B. Smith, Marion Machine

Foundry & Supply Company, spoke on "Human Engineering." At the same session Prof. C. F. Harding presented a paper entitled "The Evolution of Public Utility Regulation," in which he traced the development from individual to corporation control and reviewed the progress made in solving the problem of proper regulation. What is needed, he pointed out, is well-directed commission regulation, and if a change takes place in the direction of less stringent regulation of our utilities, he was of the belief that it will result from the following causes:

(1) Demands from consumers and regulating bodies for better and more varied service at existing rates. (2) Inabilities of utilities to meet these demands with a fair profit under strict regulation. (3) Dissatisfaction with commission regulation for the reason that too much was expected of it by the public. (4) Dissatisfaction with commission regulation for the reason that such regulating bodies are too often made up of men not experienced in the engineering and financial problems of utilities. (5) Difficulty in obtaining desired results through regulation because of an attempt to apply radical though theoretically correct methods of utility management in the immediate future.

In concluding this paper Professor Harding said: "I believe that properly regulated monopoly has come to stay for our public utilities as a happy means between cut-throat competition, with duplicate systems for which the consumer has to pay for in the end, and governmental ownership, which is bound to be inefficient, generally speaking, because of its dependence upon political prestige. Engineers have a real part to play in the success or failure of either solution of this very vital problem."

In the afternoon session on Friday the featured addresses were those of Peter Junkersfeld of Chicago and H. O. Garman, chief engineer Indiana Public Service Commission.

"Public Utility Service as Affected by Local Conditions" was the subject of Mr. Junkersfeld's address. The quality of a utility service is dependent upon local conditions, upon the habits of the users, and in this manner, Mr. Junkersfeld stated, a service will improve or deteriorate in the same proportion as the habit of the community improves or deteriorates. The influence of density of business is pronounced in its effect upon capital invested, he pointed out, saying, "the larger the capital invested in proportion to the annual revenue the more important the matter of density." The following table was given for a comparison of relative costs as to density of population:

	A. Per Cent	B. Per Cent	C. Per Cent
Generating station	12.3	12.3	12.3
Transmission system	3.2	3.2	3.2
Substation	..	4.4	4.4
Distribution to block in which home is located	..	9.3	9.3
Distribution within such block	..	58.6	12.0
Meters	..	9.0	9.0
Lamps	..	3.2	3.2
	15.5	100.0	53.4

"A" Consumer of untransformed energy.
"B" Relative cost to one man in a block of five consumers.
"C" Relative cost to one man in a block of fifty consumers.

The total investment charge in "C" is nearly one-half of that in "B," due to the difference in percentage cost of "distribution within the block." The reason for this reduction in costs, it was pointed out, is due to the fact that for mechanical reasons the poles, the primary wires, and secondary wires necessary for five customers to the block are also sufficient to supply fifty customers to the block, showing a very great influence of density on investment required to render electric service to homes.

Mr. Junkersfeld also discussed the question of sale of energy in bulk for which the investment charge is one-sixth of that of individual sale of energy. Metering and billing methods offer an important problem, the cost of which and making the collection is about 16 cents per bill each month. Mr. Junkersfeld thought it more expedient to render bills quarterly, thereby saving a considerable sum which would ultimately revert to the benefit of the consumer. It was clearly demonstrated by the speaker that the public is constantly using more electricity, due undoubtedly to the use of household appliances. The residence rather than the commercial customers are hardest to please.

H. O. Garman, chief engineer Indiana Public Service Commission, presented as his theme "Some Observations on Public Utility Control in Indiana." After viewing the conditions existing in the State for the past three and a half years and discussing the use of the commission, Mr. Garman stated that the solution of public utility problems has not been reduced to a formula as yet, but that some certain principles were taking form. The commission does not assume a paternal attitude toward the utility management, but merely a regulating relationship only pursuing investigation where complaint is made.

Friday evening a banquet was held at the Hotel Fowler. The address of the evening, "The Ethical Status of the Engineering Profession," was given by Prof. F. H. Newell, Urbana, Ill.

The convention closed on Saturday with the election of the following officers for 1917: President, C. F. Harding, La Fayette; vice-president, W. H. Insley, Indianapolis; secretary, Charles Brossman, Indianapolis; trustees, L. W. Wallace, La Fayette; J. W. Mueller, New Castle; J. S. Spiker, Vincennes; J. W. Toyne, South Bend, and J. W. Moore, Indianapolis.

WHAT CONSTITUTES ADEQUATE STEAM RESERVE CAPACITY?

Central Station Engineering Policy Reviewed by Massachusetts Commission—Cost of Generating Equipment in Large Stations

A vigorous "drive" against the Edison Electric Illuminating Company of Boston's investment in generating plant capacity was a feature of a hearing before the Massachusetts Gas and Electric Light Commission Jan. 15, in connection with the street lighting rate arbitration in progress by the board. Reginald J. S. Pigott, power superintendent of the Remington Arms Company, Bridgeport, Conn., was called by the City of Boston as an expert witness and an entire day was devoted to his examination by Corporation Counsel John A. Sullivan in support of the opinion that in comparison with other large plants, the Boston installation exceeded the necessary safe limits of reserve. The city also maintained that the cost of the plant was excessive. Cross-examination took place Jan. 16, and the verbatim testimony, now on file in the office of the board, contains an analysis of power plant adequacy seldom equalled in interest in rate regulation cases. It is expected that in the near future the company will present rebuttal testimony in defense of its policy with respect to reserve capacity and construction costs.

Mr. Pigott's main testimony was based upon his experience as engineer in charge of design and construction for the Interborough Rapid Transit Company, of New York. He maintained that a reserve capacity equal to the peak plus the rating of the largest single generating unit in the station in general affords a proper standard. At the Fifty-ninth and Seventy-fourth Street stations of the Interborough, the com-

bined rated capacity in 1913 was 172,500 kw. and the combined peaks were 149,000 kw., giving a reserve of 15.8 per cent of the combined peaks. Taking the overload capacity of the equipment into account, the witness said that the two Interborough stations could deliver 194,500 kw. The system peaks on the Boston Edison stations in the winter of 1914-1915 was 65,342 kw., the peak at the L Street station in South Boston being 60,100 kw. Mr. Pigott said that judging by his experience and by modern practice, the L Street station would have been adequately equipped if its capacity had been 75,100 kw. at this time, but with the units making up the station, 81,000 kw. would have been the nearest practicable figure. The actual rating of the units in the station totalled 105,000 kw. The witness severely criticized the retention of the original L Street 9000-kw. engine-driven plant and the purchase of the so-called No. 8 turbine (15,000-kw. rating) prior to the 1914-1915 peak. He said that the allowable units aggregating 81,000 kw. would have carried 7 or 8 per cent more load than this rating if necessary and pointed out that 9000 kw. additional is available from the Boston Elevated Railway through a frequency changer. In the winter of 1915 the peak load on L Street totalled 67,700 kw., with the same installed capacity of 105,000 kw. The demands of the Boston street lighting load were only 3223 kw., for arc lamps and 309 kw., for incandescents, as of 1914.

COST OF LARGE GENERATING EQUIPMENT

The witness estimated the cost of the L Street station, pro-rated to 81,000 kw. as $5,315,396. He contended that by rebuilding two 7500-kw. turbine sets to 12,000 kw. rating each, the company had expended $132,517 more than as though it had purchased two new 12,000-kw. machines at a total cost of $461,730, including foundations and auxiliaries. When the above machines were rebuilt the condenser base with its tubes forming the condenser proper was retained and larger auxiliaries were substituted. The original cost of the two 7500-kw. units complete was $299,621, and the cost of reconstruction was $294,625, the witness said. The cost of removing the two 7500-kw. units would doubtless have been less than their scrap value. When four 7500-kw. engine units were removed from the Seventy-fourth Street station in 1913 the purchaser in each case removed the unit and in addition paid the company $10,000 per unit. The value of the copper alone exceeded this figure.

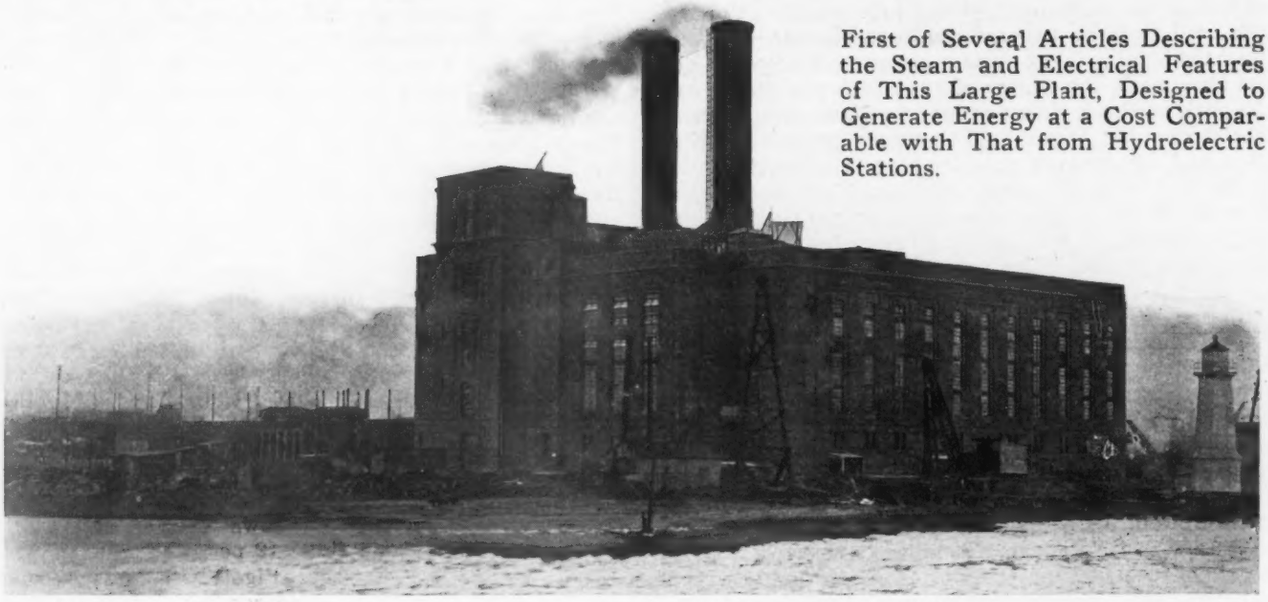
Mr. Pigott contended that a further elimination in necessary investment at L Street is represented by $512,650 corresponding to the cost of the eighth turbo-unit, of 15,000 kw. rating. He also said that the cost of the engine plant, containing six 1500-kw. units, should be eliminated, representing $1,245,014. The investment in motor-driven Brush arc generators at L Street, $154,918, should have been made a substation charge. The witness said he was convinced that there is enough margin in the equipment of the L Street turbine station to-day to safely carry the peak without the units which he would withdraw, taking into consideration the Boston Elevated emergency connection and 1400 kw. available at the Sudbury hydroelectric plant of the Metropolitan Water Board, with the further possibility of using about 3600 kw. in the Atlantic Avenue station and bearing in mind the overload capacity of the older turbine units at L Street. The total deductions of the witness figured $2,408,723. Mr. Pigott put the unit cost of the necessary capacity at L Street at about $66.60 per kilowatt, including outside coal-handling and storage facilities at present rented to the contractor who supplies the Edison company with coal.

In the balance of his direct testimony, Mr. Pigott discussed various items of station equipment which in his opinion cost the Boston company excessive amounts, including early boilers, stokers and turbines. He claimed that the Commonwealth Edison Company of Chicago had purchased 7500-kw. turbine sets at $87,500 each, compared with $100,000 at Boston and that on a 12,000-kw. unit the Boston company paid in 1907, $168,500 as against $140,000 for Chicago, for similar machines. The witness also criticized the later coal contracts of the Boston company for including a bonus and penalty clause based on analyses of nut and slack and run of mine coal. The witness said that with such a contract the company may be obliged, if using run of mine, to pay more for the same heat content, as it is possible for the nut and slack to reach the same heat content as the former.

The generating cost at L Street in 1914 was 0.48 cents per kilowatt-hour, which the witness considered good practice for the equipment combination there used. Run of mine coal cost the company $2.85 per ton and nut and slack cost $2.70. Had underfeed stokers been used, however, the witness said that the cost of production would have been cut down by 7 or 8 per cent for fuel alone and from 10 to 12 per cent including labor. "Overfeed stokers," Mr. Pigott said, "require one stoker operator and one coal-passer for about every five stokers and underfeeds require one coal-passer and one stoker for every twelve stokers. The ratio of coal cost to total production cost may rise to 80 per cent in some stations equipped with underfeed stokers." Mr. Pigott also attacked the use of storage batteries for emergency reserve service in Boston on the ground that the advances in station design have now increased the reliability of "straight" generating equipment to a point where stand-by batteries are a needless outlay. He also maintained that the street-lighting load can be handled at relatively low cost on account of its value as a long-hour, steady load in the hours of low demand upon the station.

Under cross-examination, Mr. Pigott admitted that if various turbo-units were connected to buses of different voltages with inter-bus connections through transformer banks, the amount of reserve capacity required might be altered. F. M. Ives, counsel for the Boston Edison company, brought out the point that at present one 1500-kw. engine-driven unit is run to supply energy to the 2300-volt bus, the turbines supplying the 6900 and 13,800-volt buses. The witness averred that the installation of additional transformer capacity would be preferable on account of the superior economy of turbo-generation. The point was also brought out that just prior to 1914 the Boston company had been about to close a contract for 20,000 kw. with the New Haven railroad, and the prospect of important commercial loads of this magnitude was conceded by the witness as an additional incentive to increase station capacity in anticipation of service demands. On the whole, however, the witness refused to abate his opinion that the purchase of the eighth turbine (15,000 kw. rating) was negotiated a year before it was necessary. Mr. Ives stated that the Commonwealth company of Chicago has a peak load of about 370,000 kw. and that it has nevertheless ordered 200,000 kw. for early installation. A large anticipated increase of commercial load might explain this, the witness thought. In the course of the cross-examination Mr. Pigott said that the Interborough Fifty-ninth Street station cost $150 per kilowatt originally, but that the addition of low-pressure turbines to the existing units reduced this to $87.50. The witness also admitted that an interruption of supply is a serious matter, but would not declare that wise management always refrains from taking any chances on reserve capacity.

The 210,000-Kw. Buffalo Steam Station



First of Several Articles Describing the Steam and Electrical Features of This Large Plant, Designed to Generate Energy at a Cost Comparable with That from Hydroelectric Stations.

THE erection of a steam plant almost in the shadow of Niagara Falls is an event which would in itself command interest even though the design were not the last word in steam station engineering. Low-cost power has been realized at this most famous of American waterfalls since the initial development about a quarter century ago. The limitations placed upon the further development of Niagara power by both the United States and Canadian governments and the rapidly expanding business of the Buffalo General Electric Company have combined to make the construction of a large steam station imperative. Such a station is now being completed on the bank of the Niagara River about 7 miles north of Buffalo, with an initial installation of 60,000 kw. of generating equipment. An additional 35,000-kw. unit is now on order and will be in operation early in 1918. This plant embodies the latest ideas in large steam station engineering which are expected to make possible large economies and an energy cost comparable with the cost of power now purchased at Niagara by the Buffalo company in its operation. The plant was designed and constructed in its entirety by the Stone & Webster Construction Company of Boston, with the late Henry G. Stott of New York City acting as consulting engineer for the Buffalo General Electric Company.

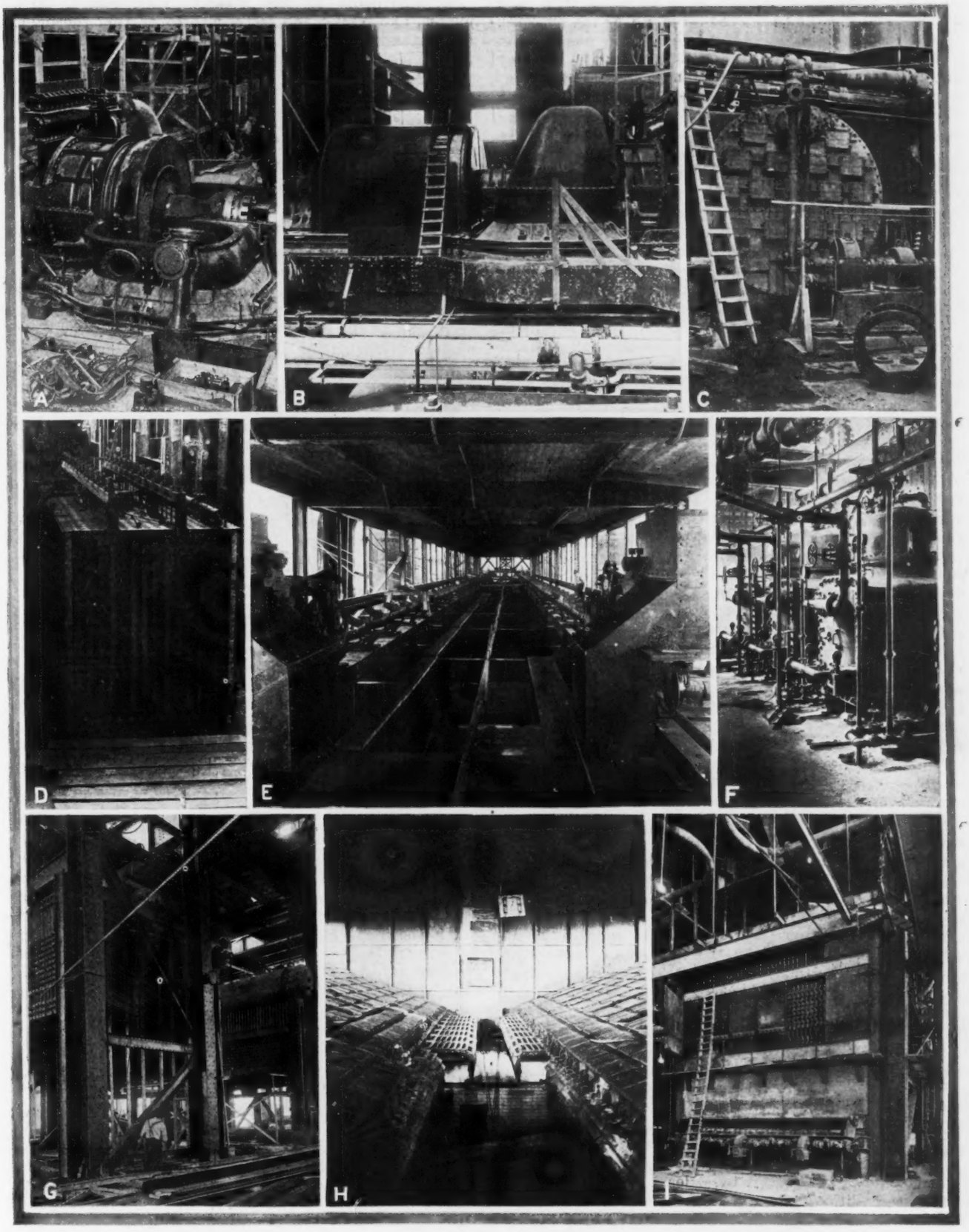
The main features of the station are the use of high steam pressure and superheat, high ratings of stoker and boilers, special piping, a special water supply system, unusual and flexible electrical arrangements. The accompanying illustrations show the apparatus during installation and some of the features of the construction.

All the energy at present contracted for by the Buffalo company from the Niagara plants is below the requirements of the former by at least 25,000 hp. Under present conditions the total load carried by the various power companies operating at Niagara has reached the practical limit of what these stations are capable of taking care of economically, and energy purchased from the Niagara companies would of necessity be more expensive than energy bought on the present basis. The new plant will insure sufficient energy to carry all peaks at present and to meet additional load demands for some time to come.

The station is located at Tonawanda, between the Niagara River and the Erie Canal. The site affords ample room for expansion and excellent facilities for the transportation of fuel by rail and water, as well as a practically unlimited water supply. The initial installation consists of three 20,000-kw. horizontal turbo-generators. The ultimate capacity of the station is 210,000 kw., and as already mentioned a 35,000-kw. unit will be added at once. Construction was begun in January, 1916, and the first turbine was placed in commission Nov. 20, a remarkable record in normal times, and especially so in 1916, considering the abnormal material and labor conditions.

The building is of steel frame construction throughout, with outside walls of brick. Main units are supported by structural steel, and all floors and roofs, coal hoppers, bunker and ash hoppers are of reinforced concrete. The interior walls are of brick and tile. The station is broadly divided into a boiler house, turbine room and electrical bay, the present building being large enough to accommodate an additional turbine unit with its auxiliaries and three additional boilers. The boiler house is 230 ft. long by 113.5 ft. wide, the turbine room being 216 ft. long by 75 ft. wide and the electrical bay 216 ft. long by 25 ft. wide. To secure a firm foundation for the building 167 concrete caissons were sunk to bed rock.

Coal is at present delivered by rail with a temporary storage maintained by means of locomotive cranes working upon trestles. The coal-handling system within the station was installed by the Mead-Morrison Manufacturing Company. A standard-gage track runs through the station parallel to the north wall. Cars may be dumped two at a time on this track into hoppers below the boiler room floor level, each hopper holding several carloads. A set of track scales is located just outside the building. Below the hoppers are located a duplicate installation of crushers discharging into two bucket elevators, one for each crusher. Each crusher is of the duplex single roll type, belt-driven by a motor, and is capable of crushing 200 tons of semi-bituminous coal per hour from run-of-mine size to 2 in. Each elevator is motor operated and is capable of lifting 200 tons of coal per hour approximately 135 ft. from the crushers to a belt conveyor above the coal bunkers. One belt conveyor, 30 in. wide and 200 ft. long, is provided for each



Views of Buffalo Steam Station During Construction

A—Steam end of one of the three 20,000-kw. generators with turbine blades exposed.

B—Assembled 20,000-kw. turbo-generator with condenser pit in foreground.

C—One of the main-unit condensers with turbine driven pump at right.

D—9435-sq. ft. economizer showing scraping mechanism.

E—Coal conveying and distributing apparatus over bunkers.

F—Two-effect evaporators furnishing boiler make-up water.

G—One of the double-end 11,403-sq. ft. boilers before stokers and setting were installed.

H—Construction of double-end grates.

I—Boiler after stoker and setting were installed.

elevator, a traveling tripper being provided with each conveyor to distribute the coal evenly over the bunkers. The belt conveyors are motor driven and push-button control is provided at four points along the runway beside each conveyor, so that in emergency the belt conveyor, bucket elevator and crusher feeding that conveyor can be stopped. An automatic device prevents the bucket elevators traveling in the opposite direction in case power is shut off. In the coal-handling bay of the station crane rails are provided for a future traveling coal unloader to be operated above the coal cars to shorten the time of unloading when necessary. Ultimately a modern coal yard with traveling bridge crane and a storage capacity of at least 50,000 tons will be arranged, and this will be connected with a coal-handling wharf on the Niagara River by traveling belt conveyors fed from hoisting towers designed for barge unloading.

Coal is fed into the stoker hoppers from a central overhead bunker of 2500 tons capacity through inclined spouts flaring into outlets over the hoppers. The boilers are set with firing aisles running crosswise of the station, which enables both ends to be readily fired from one central bunker.

Five Babcock & Wilcox cross-drum, double-ended boilers are at present installed, space for three more units being available in the present building. These boilers were designed to furnish steam at 275 lb. working pressure and with 275 deg. Fahr. superheat, each having 11,403 sq. ft. of heating surface and 484 4-in. tubes 20 ft. long connected to a steam drum 60 in. in diameter and about 30 ft. long. The ratio of heating surface to grate surface is about 36 to 1. Each boiler is fired by two fifteen-retort stokers made by the Sanford Riley Stoker Company. The cross-drum type of boiler was the only practicable type for the conditions, the chief factor in the selection being the high pressure at which these units are to be operated. With the stoker installation provided, these boilers can be operated at a very high rate of evaporation per square foot of heating surface.

The steam pressure of 275 lb. which was adopted was considered the highest available at this time without going into very special construction for boilers and steam lines. The steam temperature at the above pressure and superheat is 689.5 deg. Fahr. Each boiler was given a hydrostatic test after erection of 500 lb. per square inch, including mud drums. The setting walls are built of firebrick throughout, and are inclosed by an insulation consisting of 0.25-in. asbestos millboards, outside of which are laid magnesia blocks averaging 4-in. thickness. The entire setting is inclosed in an airtight steel plate casing with removable panels carried on the channels of the boiler room floor, which provides for expansion. The boiler fronts are of steel plate lined with magnesia 2⅝ in. thick. The disposition of the tubes and the arrangement of the baffle or flame bridges leaves the two lower rows of tubes exposed to the radiant heat of the furnace over their entire length, providing also a chamber at the bottom of the second and third passes for the accumulation of soot and cinders.

By reason of the high ratio of grate area to heating surface the rate of combustion per square foot of grate area will be lower than if the boilers were equipped with stokers under one end only, and there will be a correspondingly higher furnace efficiency and much lower cost of furnace upkeep. When burning coal at the rate of 700 lb. per hour per stoker retort, it is expected that each boiler will show an actual evaporation of approximately 140,000 lb. of steam per hour, which, under the service conditions existing, is an equivalent evaporation of about 160,000 lb. of steam per hour from and at 212 deg.

Arrangements of the stokers, economizers, fans, pumps, and piping and methods of operating the plant apparatus will be described in later issues of the ELECTRICAL WORLD with features of the electrical equipment.

WATER RHEOSTAT FOR FLUID-LEVEL REGULATION

Apparatus Designed to Serve Same Purpose as Float Switches, and Particularly Adapted to Use with Storage Tanks

Among electrical devices which have been patented recently is a cone-shaped water rheostat (patent No. 1,194,324), which is intended to serve the same purpose as float switches or other fluid-level regulating devices. According to the patentee the apparatus is particularly adapted to regulating the level of conducting fluids in storage tanks, but can also be used to automatically control bilge or sump pumps, wet-vacuum pumps, water level in boilers and the like. Since the rheostat is required to carry only a control-circuit current it is not large, being housed in a small cylindrical case which communicates with the vessel in which the fluid level is to be regulated.

As indicated in the illustration shown herewith the rheostat electrodes are nested, but are separated by a small gap depending on the conductivity of the liquid in which they will be immersed. When a conducting

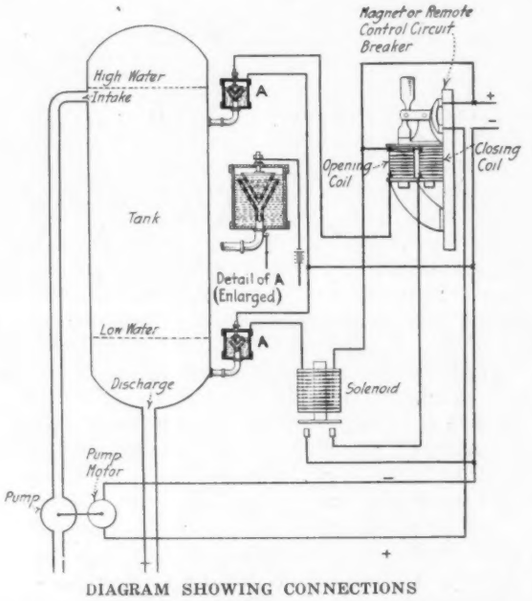


DIAGRAM SHOWING CONNECTIONS

liquid rises in the rheostat the electrodes are connected, allowing a current to flow through the control circuit, thereby operating the alarm bell, pump motor or any apparatus that may be desired. When the rheostat is used to start a motor directly without any intermediate relays the steam generated in the rheostat can escape through openings at the top. Where not much current has to be handled the conical electrodes are made 1/32 in. thick, 3 in. in diameter and 3 in. in altitude. Copper, iron or aluminum cones are used, depending on the importance of preventing electrolytic products. It may be pointed out that a metal may be selected for the electrodes which will not disintegrate rapidly in the liquid used. Furthermore, there are no movable conductors or contacts which can be damaged by arcing. Since perforations are provided in the conical electrodes circulation is assured and collection of deposits prevented in the gap between the electrodes.

Central Station Growth and Rate Reductions

A Plan Which Links the Time for Rate Reductions with the Increase in the Number of Consumers—Principles Underlying the Method Which Has Been Adopted at Milwaukee and St. Louis

THERE are several methods by which the customer may be given the benefit of the economies of quantity energy production and the extension of service by the central station. Most of these methods, however, either involve considerable additional clerical work in their application or lack the important element of maintaining existing and prospective customers' interest in the plan. Where the customers' interest cannot be maintained the beneficial effect sought to be achieved by the plan is, in large part, lost.

The plan adopted in Milwaukee is exceedingly simple. It serves the purpose of (a) maintaining existing and prospective customers' interest because of its being simple and readily understood; (b) of fixing a goal to be striven for by customers and company alike and which serves as a ready means for noting and advertising progress; (c) of sustaining the company's revenue during the period while the business is being built up to the point of justifying the promised adjustment in rates.

The plan under which the company has been working provides a definite reduction in the primary step of its residence-rate schedule whenever a given increase in business, as measured by the number of customers of all classes, has been achieved. This plan offers good reason for urging existing customers to assist in procuring new ones.

When the company had 32,000 customers on its system its primary gross rate was 11 cents per kilowatt-hour. It promised its customers and the public that when the number of customers had increased to 40,000 it would reduce the primary step of the rate 1 cent, or to 10 cents gross. At the same time the company promised that when the number of customers had increased to 50,000 the primary step of the rate would be again reduced to 9 cents gross. The difference between the gross rate and the net rate, as applied to the primary step, is per cent, this discount being allowed for prompt payment. The theories underlying the plan may be discussed briefly as follows:

Necessity for Making Lower Maximum Rates

The general tendency during the past few years in central-station rate-making has been in the direction of lower maximum rates. This has not been brought about by considerations of the cost of service, since all central-station operators realize that the short-hour user may be carried at a loss, even with an initial maximum rate of 12 or 14 cents per kilowatt-hour. It has been due to popular demand for a smaller differential between wholesale and retail rates, and in some places to the belief, shared by some central-station men, that the lower maximum rates stimulate business, as a whole, even though the service may be in some instances rendered at a loss. While it is true that the rate practices of one central-station company do not affect the rate practices of another in a competitive way, the company with the higher maximum charge is likely to suffer by comparison. Any criticism of electric rates by agitators is usually based on comparison of maximum charges. It has been found desirable, therefore, to reduce the maximum steps in rate schedules as rapidly as the business will permit.

In the Middle West two central station companies have instituted a new policy in regard to rate reductions, announcing to the public that reductions will take place at certain stages in the companies' growth. One has said: "When the company's customers reach 40,000 in number the rates will be reduced from 11 cents to 10 cents, and when the customers increase to 50,000 the rate will fall to 9 cents." A statement like this outlines the policy and program in simple language, and it makes the customer a partner with the company in an endeavor to get lower rates. The two companies referred to are the Union Electric Light & Power Company of St. Louis, Mo., and the Milwaukee Electric Railway & Light Company. The present article gives an analysis of the Milwaukee plan. Part II will give the results of eighteen months' experience with the plan at St. Louis.

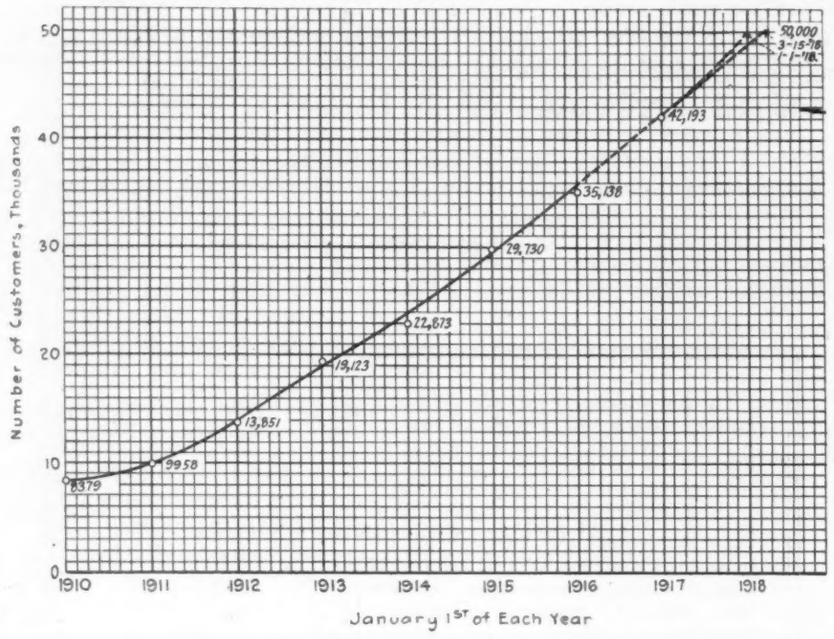
—Editors

Making the Customer Earn His Own Reductions

There is a commercial advantage in providing a definite policy of rate reductions with increase in business. Such a principle of salesmanship has been utilized before in the sale of manufactured products, and has had a marked effect in increasing sales wherever it was tried. There is no doubt in the Milwaukee case that an incentive to the customer to boost for electric service has been created. Moreover, the resulting reductions have been more appreciated because earned, than voluntary reductions otherwise made at irregular periods. While the customer may not be aware of the economic factors underlying electric-service costs, he does know that general wholesaling produces larger profits than smaller business at given unit costs, and he appreciates that the same principle applies when the electric company secures increased patronage. The customer feels, therefore, as he should, that he has earned the reduction in rate promised. Voluntary rate reductions offered without contingent responsibility on the part of existing and prospective customers, on the other hand, often leave the impression that past profits have been abnormal and the suspicion that the company could make far greater reductions under pressure if inquiry were seriously made into the reasonableness of its rates. In Milwaukee there has been an advantage in that the rate schedules of the company have been a matter of adjudication by the state commission in various cases and the rates have not been found to be unreasonable. Milwaukee customers, therefore, appreciate that the reductions are possible because of newly created economies to which they have, in part at least, contributed.

Probable Tendency to Long-Hour Use in the Future

While decreases in the maximum rate result in the short-hour user being carried at a lesser loss, it may be pointed out that this character of customer is gradually becoming of smaller importance. Under many systems of step rates the maximum rate is found to apply to all consumption during the summer months and the only benefit derived from the secondary or tertiary step is experienced during the longest winter months of December and January. In Milwaukee the customer who pays for all of his current at the primary rate is a rare exception. Under the Milwaukee company's residence room rate the primary or maximum



Curve showing the number of customers of The Milwaukee Electric Railway & Light Company in the city of Milwaukee and its suburbs as of Jan. 1 of each year from 1910 to 1917 inclusive. From the growth thus far it is estimated that the number of customers will in 1918 reach 50,000.

step applies to a load factor of about 7 per cent of the customers' demand and both the primary and secondary steps fall within a load factor of about 12 per cent of the customers' demand. As a result the great majority of the residence customers have the benefit of the secondary rate during every month of the year and the tertiary, or 2-cent step, during the late fall, winter and early spring seasons. A considerable number of customers now pay for some current under the tertiary rate during every month of the year. Due to the increased use of appliances and particularly through the development of electric cooking, it may be expected that an increasingly large proportion of the energy sold for residence use in the future will be paid for at the tertiary rate.

Influence of Density on Cost

It will be noted that the reductions made are in line with the cost of service. A considerable part of the cost of furnishing electric service arises from the cost of the distributing system necessary to reach customers scattered over a wide area. Few extensions of distribution systems are justified on the basis of an immediate return on the investment. They are built with a view that customers will be added and make them pay. The existing network of distribution lines constitutes by far the major item in the fixed charges of the cost of service. As a greater number of service connections is made, the density of business which is achieved has the effect of reducing the costs which justify high maximum charges. As these costs are reduced with increasing saturation of the territory, the customer is entitled to lower maximum rates. This is the principle upon which the Milwaukee plan of giving reductions in rates as the number of customers increases, has been worked out. As the rates are lowered the cost of electric service becomes more and more within the reach of the remaining customers not yet connected to the lines.

A factor of importance, of course, as regards future reductions, is the growth of the city and the effect, in the case of residences, of competing forms of illumination. If the population of the city is at a standstill, if it consists largely of vacant real estate which is not likely to be used for building purposes, the greatest reduction cannot be obtained. Likewise, if the service is to be divided by competing companies, the same low rates cannot, of course, be obtained as occur when the service is all supplied from one system.

In Part II of this article, which will follow in an early issue, will be given the details of how this plan has been carried out by the Union Electric Light & Power Company of St. Louis, Mo. This article will also give the gratifying results of eighteen months of experience with this plan at St. Louis.

State University Issues Bulletin to Educate Citizens on Electrical Matters

In line with its desire to be of use to the people of the State, the department of industrial and commercial service of the University of Oregon has just issued a 95-page bulletin entitled "Elementary Primer of Electricity for Light and Power Customers." This bulletin is being distributed free of charge by the University, which is located at Eugene, Ore.

The general purposes of this bulletin is to encourage the development and use of the water-power resources of the State.

The bulletin is presented in non-technical language and is reputed to be the first extensive attempt on the part of a State to educate its citizens on electrical matters. The bulletin is not committed to any cause and was prepared as an educational effort. There are many examples and diagrams calculated to indicate, especially to rural residents, the principles of electricity, types of rates, reasons for various types, and other economic features of the electrical business.

Among the matters taken up in the various chapters are definitions of electrical units, analogies between electric power and man power, fixed and variable charges, effects of load factors, types of power and lighting tariffs, and rules and regulations of the public service commissions. There is a complete chapter on electricity in the home, covering lighting, heating, cooking and general appliances.

Getting the Business in South America

Ways and Means of Starting and Developing Trade in the Large South American Markets, Where United States Manufacturers Now Have an Opportunity

BY A. H. KELEHER

A MANUFACTURER who desires to get business in South America, but who has had no previous experience in that market, should first find out whether there is a demand for his product. He can do this by calling on export agents and commission houses in New York City. He can find out what the probable volume of demand would be and how his material must be changed and adapted for the South American market.

However, any manufacturer who has material which would meet with ready sale in South America ought to be in that market already. If he is not, then either his material is not suitable for sale in South America or there is some broad controlling reason why he does not wish to sell there.

If the manufactured product is good and the prices are reasonable, there are men who are looking for good material all the time. Such men would have worn a path to the factory before now. There are manufacturers who have material which is salable in South America, but who do not wish to sell it there. I know of a well-known manufacturer of electrical glassware who gets so large a business in North America that he is not interested in South American prospects.

After a manufacturer has found for himself whether there is a demand for his material in South America, the question of the volume of sales he can make should decide the methods which he will follow in entering the market. He could either send his own man direct, give his agency to a manufacturer's export agent who travels for allied lines in South America, or merely solicit business through the New York commission houses that are constantly in the market for such material as he produces.

COMMISSION HOUSE ARRANGEMENT

If a manufacturer is working on a very small capital it would be better for him to make some arrangement with a commission house because he will be paid cash in New York for his material. But in exchange for this security of payment he will get a minimum amount of business. This might be a good way to begin. I have known manufacturers who began in this way and after their business became developed to a certain point gave the agency to a manufacturer's agent.

A manufacturer's agent is in a much better position to specialize than a commission house that sells anything from needles to haystacks.

Only very large firms that make material which is in great demand in South America and that are in a position to compete with the world should send their own men to South America, for otherwise expenses would be too heavy for the volume of business secured.

If a manufacturer sends his own salesmen, he is confronted with the problem of securing a good man, one who speaks Spanish and Portuguese and is gentlemanly, diplomatic and tactful. It is difficult to get such men in this country.

A manufacturer should advertise his products in South America. Usually manufacturers claim that they cannot afford to advertise there. I have known manufacturers who are tremendous advertisers in this country but who were unwilling to do very much in South American markets. This is to be regretted; I have always claimed that advertising pays double in South America. In the Argentine, for instance, the people are peculiarly receptive to advertising. Rates in the principal magazines and newspapers, of which there are many that are good in South America, are extremely reasonable. If a manufacturer has a special trade mark he can make it known by constant advertising and afterward it will have preference over any other brand in the Argentine. I have in mind particularly one popular American electrical article in the Argentine and Brazilian markets. Three years ago people talked price only but now in many cases they demand this article by its trade name.

In order to succeed, a manufacturer must have not only a good selling agent, but he must have also a good export manager imbued with the export idea. To illustrate this point, the export manager for a large American manufacturer is one of the cleverest in the business. He has made this reputation in three years. He not only has a successful South American business but he has expanded his export trade throughout the world. He has the export idea developed to its highest extent. With such a man at the head of the export department, success cannot be denied. In the same line of electrical material I know several other manufacturers who are getting little or no business in South America. I do not believe that they have "the export idea."

ADAPTATION IS NECESSARY

In order to develop trade an American manufacturer should use "adaptation" for his motto. By this I mean that he should adapt his languages, methods and articles to the needs of the people with whom he is to deal and in doing this he should have a different adaptation for each country.

In a great many respects, Brazil should be treated differently from Argentine. For instance, many manufacturers do not attach the proper importance to the difference in languages in Brazil and Argentine. A manufacturer should get out a small Portuguese catalog for Brazil and a Spanish catalog for all of the rest of South America.

What steps other than the securing of representation is it necessary for the manufacturer to take—that is to say, in the way of obtaining licenses for the traveler, shipping connections, provision of an export organization at the home office, study of credit and exchange, training of employees, special methods of packing, etc.? It is scarcely worth while to go into detail on these questions because they are so simple and they cease to become problems as soon as you get a good person or firm to take up the representation in South America.

As to how long it will take a small manufacturer to develop a market for his products in the principal South American centers, that depends, of course, on the value of the selling proposition. If the material is good and the prices are right and the export manager has the export idea and the selling agent is a good one, three years will bring very good results. There should be no expense to this if the proposition is a sound one; that is, if the expenses are carried over three years. One manufacturer of electrical glassware made his expenses during the first year and in the next two succeeding years made good profits.

In one respect, the present is an opportune time for a manufacturer to enter the South American markets and in another respect it is an inopportune time. This is our opportunity because our most intelligent competitor, who lives in Europe, is otherwise engaged, leaving the market for us. It is inopportune because it offers us an opportunity for getting a very bad reputation for giving poor service and poor delivery. I refer to conditions which exist whereby an American manufacturer receives an order for a shipment to a South American country, and due to the fact that his domestic business is so flourishing, takes from six to eight months to make deliveries in South America. The American manufacturer is getting an unprecedented amount of business from all parts of the world, and he is making many mistakes in his export trade. European manufacturers are making capital of this condition. Many South American customers state that they will take their business away from us immediately after the war because of the poor way in which we handle it.

Finally, conditions have improved in South America during the last two years. But, due to many reasons, they are far from normal at the present time. However, there have been very few losses during the last year, and in general it is quite safe to do business with the average South American importer because he is extremely honest. He is, therefore, entitled to credit, his demands in this respect usually being ninety days.

Is the Central Station Customer "Always Right"?

An Answer Based Upon an Ohio Company's Twelve Months' Experience with Its New Bureau of Adjustments

BY FRANK WERT

Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

BELIEVING that the customer with a complaint, and the company itself should have a common meeting place, the Youngstown (Ohio) central station one year ago established its Bureau of Adjustments, creating also in this way an agency for the reparation of errors, for the adequate explanation of misunderstandings, and for making plain the simplicity of some of those processes which appeal to the uninitiated public as deep mysteries.

In the following paper, read before the meeting of Ohio new-business managers at Toledo last week, Mr. Wert recounts the experiences of twelve months' operation of the bureau, and expresses his belief that the customer *is* always right till it is proved otherwise.

FOR many years the affairs of public utilities were looked upon, both by those within and those without, as something apart from ordinary businesses; but that is no longer so. More and more successfully are the men engaged in this line of endeavor forcing recognition of the fact that the central station is properly a business, and that the service the central station sells is strictly analogous to the goods on the merchant's shelves; the uses in which the kilowatt-hour are consumed parallel those of food, or coal, or clothing in the household; the effect of economic conditions, of labor costs, of prices of materials, on production costs, prices to the consumers and profits of the central station are no whit different, broadly speaking, than the effect of these forces on any other industrial or commercial enterprise.

If these statements are true, and I believe they are, then the application of mercantile methods to the business of the central station in its transactions with its patrons is proper. If "the customer is always right" in the retail dry goods store, is he not always right in the electric light company's office?

RESPECTS IN WHICH OUR BUSINESS IS "DIFFERENT"

On broad, general grounds our business is similar to that of any merchant, but, of course, in a more restricted sense there are distinct differences, and several of them have direct bearing on the relations of the companies to the consumers. In the first place the customer is not thoroughly conscious of the delivery of our commodity for his consumption. The grocer's boy makes his rounds and leaves substantial evidence, in the form of coffee, sugar, flour, potatoes, of the fact that something has been bought and must be paid for. The delivery of electricity is silent, unseen, and coincident with the desire to use it. There is no consciousness on the part of the customer of receiving something before it possibly can be put to use. The only concrete transaction is the receipt of the bill long after the service has been thus insensibly used.

Secondly, the means of measurement is not such as is to be possessed personally by the consumer or to be checked and verified readily by him. Kitchen scales, yardsticks and quart measures may easily be employed to give assurance that full quantities are being received; but we do not have electric meters stowed away in the cupboard to be brought forth and used at any time we may feel that the amount of electricity being used and the amount being paid for vary. The nearest approach in form to the electric meter in common use, perhaps, is the watch, but even here the owner may stop at any jeweler's window and ascertain for himself just how much, if any, his timepiece departs from the standard.

In the third place the customer of a public utility cannot, usually, change from one dealer to another at will. He forgets, perhaps, that this lack of competition for his trade is more than made up by regulation by public utilities commissions and that this is a surer safeguard for the consumer than unregulated competition. This probably accounts in a measure for the fact that many patrons of a public service corporation will not accept as axiomatic that its business properly should be considered on the same plane as that of a department store and therefore that some will descend to practices, which, if directed toward any merchant, would be admittedly, even in their own minds, cheating and theft.

If you accept these statements as approximately correct, then, is it not even more important for the central station than for the department store to provide a common meeting place for aggrieved patron and company; to establish an agency for making reparation for errors; to assure adequate explanation of misunderstandings,

and to make plain the simplicity of some of those processes which appeal to the uninitiated as deep mysteries?

It seemed so to our company and a little more than a year ago we established what we call the "Bureau of Adjustments." We avoided the designation of "Complaint Bureau," for we did not want to give the impression that a patron must "kick" to get a hearing. "Come in and talk it over with us and let us both see whether we cannot find out what is wrong" was the gist of our invitation to our patrons.

Immediately, of course, arose the question: "Is the customer always right?"—for, despite the fact that the business house, which promulgated the pronouncement that the customer is always right, has repudiated the essence of that slogan, the thought has taken its place among the rules of business and the question of just how far the customer shall be considered right must be answered if the sharp corners in the relations between buyer and seller are to be blunted and smoothed.

Our conception of a Bureau of Adjustments led us to make it independent of the jurisdiction of the accounting and treasury departments, against which the grievances of customers naturally would be directed. We wanted to be in a receptive mood and we did not want to be too greatly handicapped by an affectionate regard for methods of doing business which might come under the fire of patrons. We wanted to find out to what extent rules and customs proved irksome to our consumers. But above all we wanted to find out just how far the customer must be considered right, and therefore we wanted a sort of intermediary between the complainant and the defendant department.

In the year just closed the bureau received 1482 complaints. Of this number 635, or 42.8 per cent, were settled in the bureau without the necessity of reference to the departments affected. The remaining 847 were referred to one or more departments for information, investigation or advice. Of the whole number 67 per cent, or approximately 1000, were from consumers of electricity.

Nearly one-half of these complaints, or to be exact, 435, were based solely on the contention that the "bill was too high," while 227 challenged the accuracy of the billing, leaving something more than 300 for the various other grounds for grievances. Fully 75 per cent of the cases affecting the electric department revolved directly around the question of how much money was due the company.

And out of those 746 cases only one complainant expressed the fear that his bill was too small. When our supervisor of adjustments heard that man's story he threw his arms around him and wept on his shoulder.

Some of the Incidents

A man whose bill normally should be about $3.50 came in to complain of a bill he had just received for $14. He had been a steady consumer and his account showed only the seasonal fluctuation. His meter reading was found to be absolutely correct and his meter proved on test to be 99.9 per cent accurate. His installation revealed no cause for a sudden increase in consumption. Furthermore the check reading showed that his use of electricity had returned to normal.

Was that customer right in his contention that his bill was too high? One hundred and fifty more units than usual had passed through his meter. Of that there was no doubt. Whether a ground that had burned off is an acceptable explanation or not, it appeared certain that this customer had had no use of those 150 units and our bureau took the view that he was right and gave him credit accordingly.

Within a few days another customer presented an almost similar case, apparently. His bills seldom had gone above $1.50, but this time it called for $13.65. He was sure he had not used the current.

"Have you been using an electric heater?" he was asked.

"Oh, yes," he replied. "My wife and I think it is very pretty and we let it on all night."

He freely told how long and for about what hours he had used this device. The result in watt-hours, and kilowatt-hours was figured out for him and his parting comment was: "That's one on me."

Again a man came into the bureau who had consistently been receiving a minimum bill. This time the bill called for $1.01, or 1 cent more than he had previously paid.

"It's not the cent," he explained, "but I don't intend to pay you more than is coming to you."

His account for some months back was gone over as carefully as though the amount involved was of real consequence and the principle of the minimum charge and the measurement of current was explicitly explained. He was satisfied about that cent, but he made another startling discovery. He usually had not consumed as much current as he could have done and still have paid only a dollar. This fact impressed him and he announced that he did not intend to let anything like that get by him again. He would buy an electric iron and use up his full dollar's worth each month. We were satisfied, for we felt sure that he had taken himself out of the dollar class for good and all.

Is a Customer Right When He's Wrong?

But the question remains, were these customers right? Did they have a real grievance? We feel that in these cases and in innumerable others which might be cited, the customer in his own mind was absolutely convinced that he was right. The grievance actually existed and the fact that it could be removed by explanation made it no less real than if a refund had been necessary to make reparation.

That the removal of such grievances is important I believe is demonstrated by the fact that only a negligible number of our customers have returned after they once have received a full explanation which has satisfied their doubts and suspicions. It is not hard to satisfy a complainant when a real error is found; it is only when the error is in their own understanding that the problem is difficult. To aid in this work our bureau uses charts showing the varying hours of darkness and daylight, a board equipped with lamps of varying sizes and glass-incased meter and similar devices.

Naturally, when a customer goes beyond the mere assertion that his bill must be wrong and tries to supply a diagnosis, he turns to the meter. Either, he decides, it must be "fast" or else the reader was careless.

To the average customer the meter is a mysterious thing. He is apt to conjure up all sorts of weird things that the meter can do or that can be done to the meter. Some of them go so far as to think that the meter should be eliminated as wholly undesirable, and install "jumpers" as their solution of the evil.

Our own idea of a solution is somewhat different—it is to rob the meter of its mystery and not the company of its income. Our bureau never misses an opportunity to explain the working of the meter and the manner of reading it. These explanations are made with the meter in the bureau's office, lamps of various sizes are placed in action, the consumer is asked to count the revolutions of the disk and to compute the consumption and a booklet is given to him explaining how the meter should be read.

"That's all right with your meter here in the office," said one skeptic, "but how about mine at home?" That's the one that's fast."

"But, my dear man," was the reply, "I am telling you

all this so that you can do the same thing at home." And then for the first time, his suspicion showed signs of giving way.

"Do you mean," said another as he received the explanation and the booklet with spaces for him to mark his meter readings, "that you are willing that I should read that meter?"

"Of course," he was told. "We are anxious to have all of our customers able to read their meters."

"Well, if that is the case," he came back, "what is the use of my doing it?"

A Good Memory Will Help Prevent Repeated Impositions

There are other classes of complaints which are a bit more difficult. Every month in the last year we have had one or more complaints based on the allegation that the demand rating was wrong. Out of twenty-one such cases one allegation was well founded. Every other one was based on the mere fact that the next door neighbor, whose house "is just the same size and who burns more light than I do," had a lower rating.

Every month also we have had people demand the discount privilege after the discount period had expired. This class of complaints has revealed quite a percentage of complainants who are not right and furthermore who apparently know that they are not right. What they want is a special privilege, an exception in their case. It is difficult sometimes to convince them that the improper granting of a discount would be discriminatory and therefore illegal. Sometimes they admit cheerfully that the rule should be enforced against all but themselves.

One man claimed the discount on the ground that his bill had not been mailed to him. The case was investigated and doubt as to whether the bill had been mailed was aroused. The customer was assumed to be right, his version was accepted and he received the benefit of the discount.

Seven or eight months later he came again. He had mislaid his bill and had forgotten to pay it. He would be gratified, he said, to receive the benefit of the discount. He was not gratified, and furthermore our assumption that we had done the just thing some seven months before was shaken. Apparently this customer was far from right.

Another customer claimed the discount, saying that five days before the discount period expired his house had been quarantined and that therefore he had not had a chance to avail himself of the discount. Of course he could have paid the bill in the early part of the discount period, but—well, the doubt was resolved in his favor and he certainly felt that nothing more than justice had been done him.

The Customer Is Right Until He Is Proved Wrong

We do not feel that our thirteen or fourteen months of experience and observation have found the absolute answer to "Is the customer always right?" but it has led us to certain definite conclusions with regard to our relations with our customers.

We have invited all our patrons to come to us with any misunderstanding or grievance. Every bill carries that invitation and so does every transfer issued on our railway lines as well as occasional newspaper advertisements. We have made 145,000 meter readings and issued approximately as many bills in the last twelve months and 1000 electric customers have made complaints, though many of them have been little more than inquiries. On the basis of these separate transactions with our customers there thus has been less than seven-tenths of 1 per cent of complaint, perhaps less evidence of dissatisfaction than sometimes might be expected.

Among these complainants there have been very few who avowedly have remained dissatisfied. For the most part the efforts of the adjusters have been successful and those who voluntarily have expressed appreciation of fair treatment have far outnumbered those who have refused to be mollified. Some, when the light of understanding has dawned upon them, have asked pardon for needlessly taking up our time, while others have come back with the statement that "you straightened that other matter out so nicely for me that I thought I would ask you to look into this also."

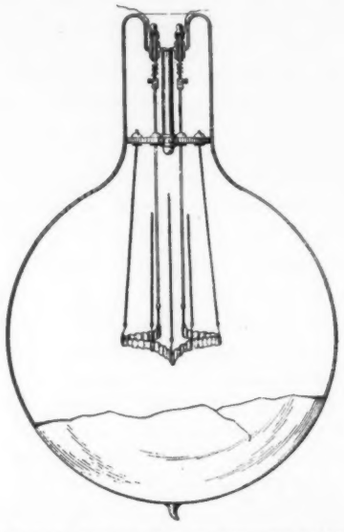
We have noted only a comparatively small number of cases in which it was evident that the complaint was made in bad faith. In nearly every case the grievance is real and convincing in the mind of the complainant or else he would not come near us. True, some of them feel that they must "stand up for their rights and fight" but when they find that they not only are welcome, but that they may tell all that they feel and then they are questioned for further details, they usually lose this combative feeling and are willing to discuss their grievances as business matters.

We started our Bureau of Adjustments on the basis that each grievance is real, is truly presented and must be heard in that spirit. It cannot be heard in any other spirit, if good is to be accomplished. As former President Taft put it in a recent address: "You cannot convince a man if you base your arguments on the assumption that he is a fool."

Our answer then to the question "Is the customer always right?" in so far as we can give one, is that the customer is always right till it is proved otherwise.

Incandescent Lamp with Ribbon Filament

Frederick G. Keyes discloses in patent No. 1,206,333 a method of increasing the light-giving quality of tungsten filaments by forming the latter into crimped ribbons. Naturally the potential has to be diminished in consequence, whereas the current rises to from 3 to



RIBBON FILAMENT TUNGSTEN LAMP

50 amp. A further evident advantage is that the filaments are less fragile than those in ordinary commercial use. In this way lamps of exceedingly high candle-power are obtainable without visibly shortening the life of the lamps. The patent has been assigned to the Cooper Hewitt Electric Company of Hoboken, N. J.

Features of New Jersey Company's New Station—II

Arrangements Made at the Essex Station of the Public Service Electric Company for Providing Continuous Excitation and Assuring Reliable Operation of the Station Auxiliaries

BY P. H. CHASE

Member of the Engineering Department of the Public Service Electric Company of New Jersey

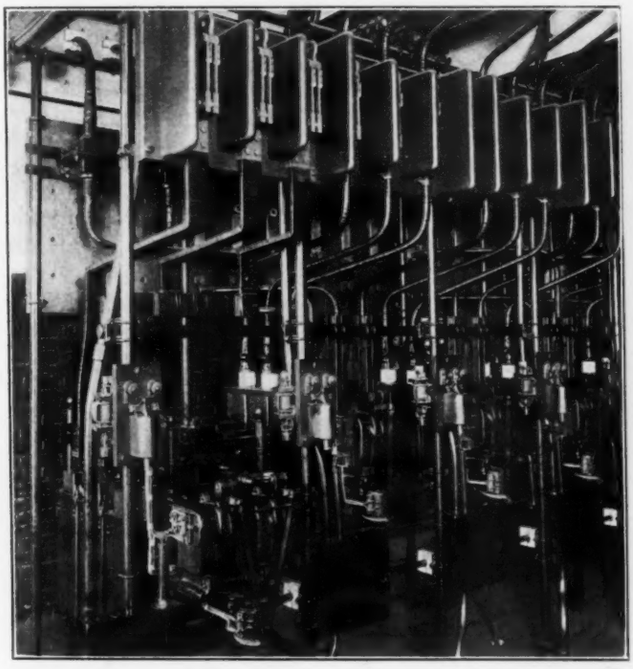
IN the last issue of ELECTRICAL WORLD were described the general layout of the Essex station, main electrical connections, switching and protective schemes, type of control and high-tension testing equipment. This article deals with the arrangements for successively connecting independent sources of excitation energy, assuring the operation of the plant auxiliaries, signaling and communicating between departments and illuminating the station.

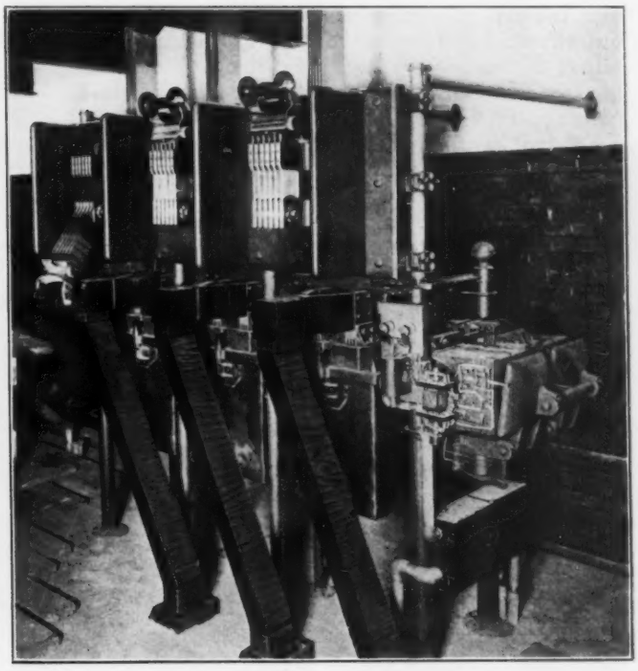
PROVISIONS FOR ASSURING RELIABLE EXCITATION

Regular, emergency and spare excitation is furnished so there is little possibility of interruption to service due to excitation. Regular excitation is furnished by the shunt-wound exciters directly connected to the generators, thus trouble with the excitation of one unit cannot affect the other units except through its effect on the 13,200-volt buses. Trouble with the excitation of a generator, however, will automatically cause the substitution of the emergency supply. Emergency excitation is obtained from a 250-volt exciter battery located in the switch house, to which the field of any generator can be connected, either automatically or by the switchboard operator for a short time, until the spare excitation supply is made available. Spare excitation is obtained from the 150-kw. shunt-wound, motor-driven exciter in the turbine room, which may be started up, connected to any generator field, and wholly controlled by the switchboard operator to take the place of the faulty direct-connected exciter.

In case the voltage across the generator field drops to a low value, a low-voltage relay instantly closes a circuit breaker connecting the exciter battery to the generator field and causing the direct-connected exciter circuit-breaker to open from reverse current; thus the effect of trouble on the direct-connected exciter is quickly eliminated automatically. While the emergency battery is carrying the load temporarily the operator can start the spare exciter, parallel it with the battery and then disconnect the battery. The latter will then be in readiness for trouble on another generator field. The spare exciter control connections are arranged so that they may be transferred to the panel controlling the generator which it is exciting.

A contact-making voltmeter is provided for maintaining the exciter-battery voltage near that of the direct-connected exciters so excessive voltage fluctuation will be avoided when a generator is suddenly connected to the battery. The end-cell switches are in duplicate to permit charging the battery at the same time it is discharging, as well as for interchangeability. The battery is designed to supply 900 amp. at 250 volts for thirty minutes, which is sufficient to excite one 25,000-kva. generator at full load for over one hour, or two generators for one-half hour.





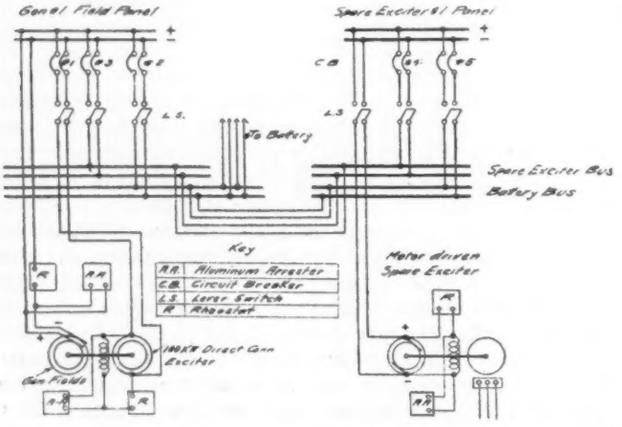
FIGS. 1 AND 2—SECTION OF HIGH-TENSION STATION-SERVICE SWITCHING APPARATUS AND TRANSFORMER SECONDARY SWITCH

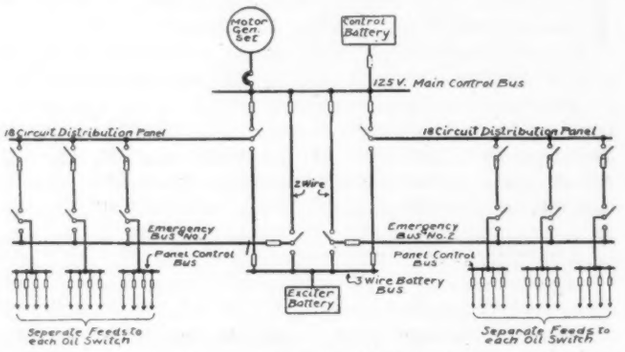
Aluminum-cell arresters are connected across the field terminals of each generator to absorb the "inductive kick" or rise in voltage resulting from short-circuits on the high-tension windings and disturbances in the field circuit. Others are also connected across the fields of the exciters to prevent reversal of polarity. This novel application of aluminum-cell arresters has proven much superior to the usual discharge resistance by protecting the field against high voltages and by simplifying connections.

FEATURES OF STATION POWER SYSTEM

Since electricity is used to drive many of the boiler-house and turbine-room auxiliaries in addition to furnishing station lighting, maintaining the integrity of

the station power system is second in importance only to that of the control system. Consequently a very complete scheme of main and relay connections is provided to minimize and restrict power service interruptions. A voltage of 440 was selected on account of the greater safety afforded the station force than with 2400 volts,





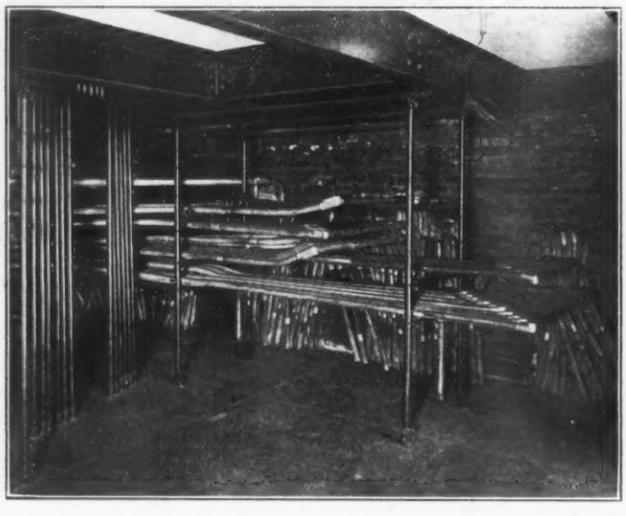
FIGS. 3 AND 4—ARRANGEMENTS FOR EXCITING TURBO-GENERATORS AND FOR ENERGIZING CONTROL SYSTEM

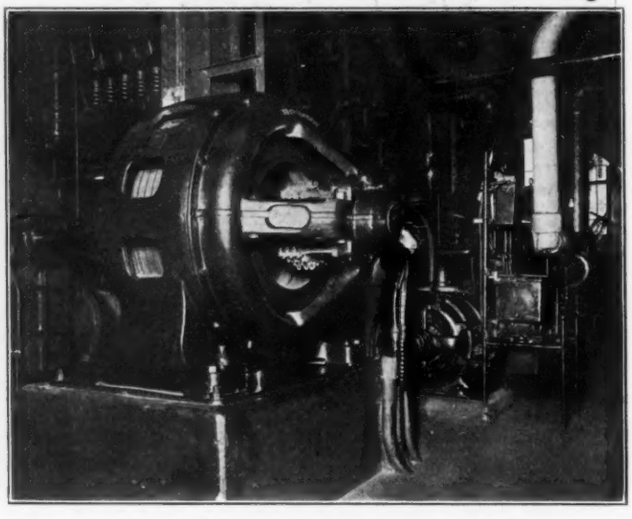
and also on account of the great saving in cable and bus investment compared with 220 volts. Where required, variable speed control of motors is obtained either by changing the motor winding connections or by secondary resistance. Close speed adjustments are obtained by mechanical means.

Control equipment for the station-service apparatus is located on the first and second floors of the switch house. The switchboard on the second floor controls the station power and lighting equipment and exciter battery charging, partly duplicating the service of one of the boards in the main control room.

The station power system is supplied at present by two 3000-kva. 13,200/400-volt water-cooled transformers, one being a spare. A third unit will be installed this year, space being provided in the switch house for a total of four 3000 kva. transformers. The transformers are supplied from the 13,200-volt buses through the feeder oil switches, and the 5 per cent reactance coils. Provisions have been made to serve them directly from the tie feeders from other stations in case of emergency. The transformers are equipped with water-flow indicators and thermometers, which operate an alarm in case a transformer in service has no cooling water or becomes overheated. On account of the large connected horsepower in motors, the load on the station power system even with the present installation is considerable and the ultimate load will be about as large as that now carried as commercial load by the company's largest sub-station.

The wiring layout for the station power circuits is shown in an accompanying diagram. The transformer secondary leads and the 440-volt buses consist of six 0.25-in. x 5-in. copper bars per phase. On account of their great weight and the tremendous mechanical forces which may result from short-circuits on the 440-volt system with so much generator and transformer capacity, the bus bars are ruggedly supported. The transformer leads and the tie bus are carried on double supports and covered where possible. The group buses are inclosed in a concrete structure with doors and are mounted on supports bracing them three ways. All of the oil switches are electrically operated. From the 440-volt feeder switches in the switch house, power is distributed directly to the individual motors or to local distribution centers from which the motors are supplied. One direct-power feeder is provided for the two motor-driven auxiliaries for each turbine—a circulating pump and a dry vacuum pump. An emergency feeder for each dry vacuum pump is obtained from the feed to another unit.





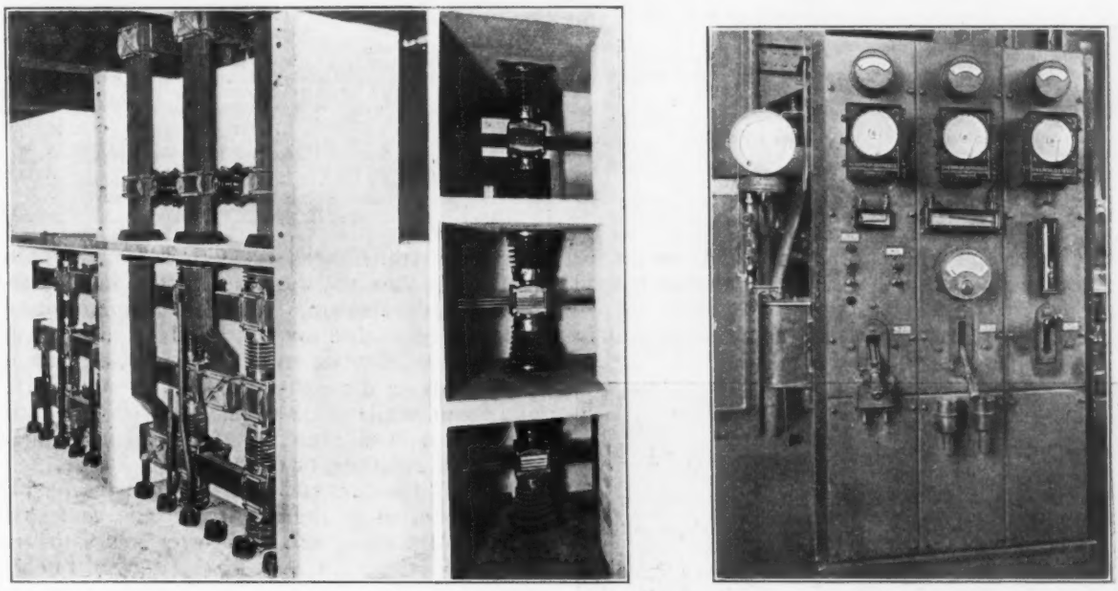
FIGS. 5 AND 6—PORTION OF CONDUIT ROOM UNDER CONTROL ROOM AND SOME MOTOR-DRIVEN AUXILIARIES INCLUDING A CIRCULATING PUMP

The power-distribution system for the boiler house required particular attention on account of its importance and the large loads. The power-distribution center for the equipment in the first section of the boiler house is located on the north or river side of the boiler-house basement. Provisions will be made for a similar

distribution center in each of the two future sections, and for four large main feeders from the switch house 440-volt power buses to each of these centers. Each of these feeders consists of three 500,000-circ. mil. three-conductor cables.

Power is distributed from the boiler-house distribution center, through electrically operated oil switches, either to individual motor feeds or to distribution panels from which several motors are supplied. The air compressor and the fire pump have individual feeds. The oil switches for these panels are controlled from the boiler-room engineer's office. Individual switchboards are mounted near each boiler. From these panels are controlled the respective group oil switch and the switching equipment for the stoker, forced-draft and induced-draft motors. Indicating and recording meters are also mounted on these panels to give steam flow, draft, temperature, motor current and stoker shaft speed. Many valves in the steam and water piping are motor-operated to permit rapid remote control of valves in emergencies. They are also supplied from the exciter battery. Control is obtained by double-throw lever switches or controllers, with indicators to show the position of the valves. The control for all motor-operated steam valves in the boiler house is also located in the boiler-room engineer's office. A controller permits operating the stoker-drive motor at four speeds, while a throw-over oil switch allows the forced draft blower motor to be run at two speeds.

It is apparent that the reliability of the power service throughout the station depends very largely upon the methods used for protecting the transformers, group buses, main feeder oil switches, distribution centers and branch circuits against interruptions. The power transformers are equipped with instantaneous differential relays which will open both the 13,200-volt primary oil switch and the 440-volt secondary oil switch only in case there is a short-circuit in the transformer or in its primary or secondary leads. Each 13,200-volt primary oil switch is equipped with an overload relay with a high time setting to clear any trouble which has not been cleared by the various 440-volt oil switches. The 440-volt tie-bus oil switches are equipped with inverse time overload relays so that a severe short-circuit on



FIGS. 7, 8 AND 9—ARRANGEMENT AND SUPPORT OF 440-VOLT BUSES AND TYPE OF BOILER CONTROL PANEL

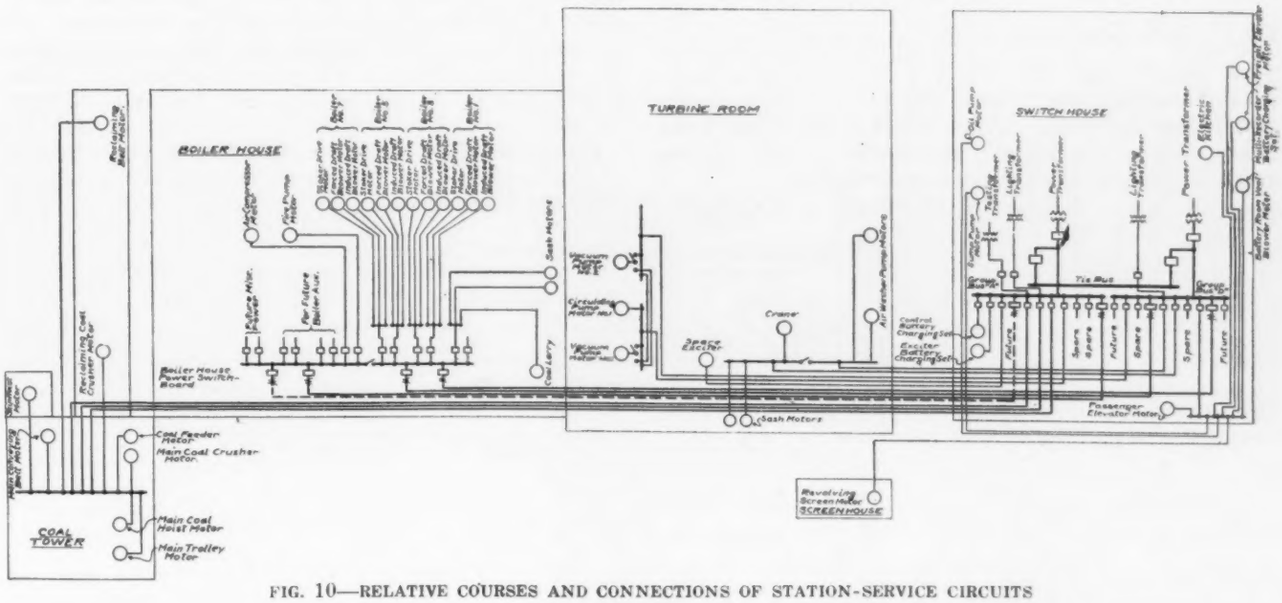


FIG. 10—RELATIVE COURSES AND CONNECTIONS OF STATION-SERVICE CIRCUITS

TABLE I—ELECTRICAL EQUIPMENT OF COAL TOWER AND BUNKER

Equipment	Type	Rating	Operating Condition	Manufacturer
1 hoist engine	Two-drum	24-in. drums, 200 r.p.m.	240 tons per hour	Maine Electric Company
1 H. E.-motor	Induction	410 hp., 200 r.p.m.	Direct connected to engine	General Electric Company
1 traversing engine	Single drum	30-in. drum	Gear-driven motor	Maine Electric Company
1 T. E.-motor	Induction	75 hp.	Constant speed	General Electric Company
1 feeder	Apron	5 ft. wide, 16 ft. long	Gear-driven motor	Stephens-Adamson Company
1 feeder motor	Induction	7.5 hp.	Constant speed	General Electric Company
2 crushers	Two-roll	36 in. by 36 in. rolls	Gear-driven motor	Robins Belt Conveying Company
2 crusher motors	Induction	35 hp.	Constant speed	General Electric Company
1 conveyor	Belt	30 in. by 161 ft. long	300 tons per hour	Robins Conveying Belt Company
1 conveyor	Belt	30 in. by 120 ft. long	200 tons per hour	Robins Conveying Belt Company
1 conveyor motor	Induction	20 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 conveyor motor	Induction	10 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 automatic skip hoist	Balanced	2-ton buckets	100 tons per hour	Maine Electric Company
1 skip-hoist motor	Induction	25 hp.	Constant speed	General Electric Company
1 elevator	Electric freight	7.5-ton	50 ft. per minute	Reedy Elevator Company
1 elevator motor	Induction	40 hp.	Constant speed	Lincoln Electric Company

a feeder of one group will trip the tie-bus oil switch for that group bus and thus not affect the other tie-bus oil switches. All the 440-volt feeders are protected by inverse definite-time overload relays so adjusted that in

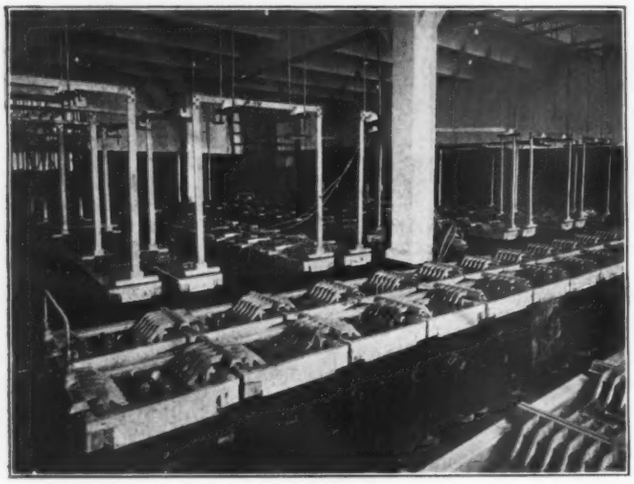


FIG. 11—ARRANGEMENT OF STORAGE BATTERY CELLS AND END-CELL COPPERS

case of a severe short-circuit the tie-bus oil switch for that group bus will open first, isolating that group bus. The feeder oil switch will therefore rupture only the short-circuit current from one transformer, instead of three or four. Differential relays are also connected to current transformers at each end of the boiler-house feeders so they will isolate a feeder in case there is a short-circuit thereon. All of the boiler-house branch circuit oil switches are protected by inverse-time overload relays. Protection against short-circuits in cables supplied from distribution panels is obtained by overload fuses, while overload and low-voltage protection at the motors is obtained by the usual starting compensators, oil switches, or contactors.

Watt-hour meters and ammeters are provided throughout the station in the circuits of the various turbine-room, boiler-house and coal-tower motor-driven auxiliaries to enable the operating department to check their operation. On account of the large number of meters required and the balanced loads on the motors, single-phase watt-hour meters with "Y-boxes" are used.

ARRANGEMENTS FOR ILLUMINATING STATION

The lighting system, which is 250-125-volt three-wire, is regularly supplied from two 200-kva. single-phase transformers, fed from the 440-volt 60-cycle power buses. Provision is made for a third transformer. In emergencies direct-current energy may be supplied from the exciter battery. The regular lighting makes up about four-fifths of the total lighting throughout the station. From the main lighting buses, main feeders are run in duplicate to each lighting-distribution panel, thence branch feeders are run to each panel board.

Emergency lighting makes up the remaining one-fifth of the lighting. As long as there is proper voltage on the main lighting buses, one set of contactors is closed,

TABLE II—PRINCIPAL ELECTRICAL EQUIPMENT OF BOILER HOUSE

Equipment	Type	Rating	Operating Condition	Manufacturer
8 stokers	Underfeed	16 retort 15,000 lb. coal per hour	Continuous dumping	Sanford Riley Stoker Company
4 Reeves transmissions		Class F, No. 6	Variable speed	Reeves Pulley Company
8 stoker motors	Induction	12hp.	Four speed	General Electric Company
8 forced draft blowers	Turbovane	60,000 cu. ft. minute	Two-speed, motor driven	B. F. Sturtevant Company
8 F. D. B.-motors	Induction	150 hp.	Two-speed	General Electric Company
8 induced draft fans	Multivane	106,000 cu. ft. gases 400 deg. F.	Constant speed, motor driven	B. F. Sturtevant Company
8 I. D. F.-motors	Induction	100 hp.	Constant speed	General Electric Company
1 fire pump	Two-stage centrifugal	1,000 gal. per minute	110 lb. total head	Lea-Courtenay Company
1 fire-pump motor	Induction	100 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 air compressor	Straight line	225 cu. ft. per minute	100 lb. pressure	Ingersoll-Rand Company
1 alternating-current motor	Induction	75 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
2 service pumps	Single-stage	500 gal. per minute	110 lb. total head	Lea-Courtenay Company
2 S. P. turbines	Horizontal	22 hp.	190 lb. gage, 150 deg. superheat	Westinghouse Electric & Manufacturing Company
1 air compressor	Straight line	100 cu. ft. per minute	100 lb. pressure	Ingersoll-Rand Company
1 alternating-current motor	Induction	15 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
2 coal larries	Weighing	15-ton	Motor driven	Robins Conveying Belt Company
2 ash locomotives	Electric storage battery		Storage battery	Westinghouse Electric & Manufacturing Company
1 charging equipment	Motor generator	15 kw.	For electric locomotives	General Electric Company

TABLE III—MAIN ELECTRICAL EQUIPMENT OF TURBINE HOUSE

Equipment	Type	Rating	Operating Condition	Manufacturer
2 generators		25,000 kva.	13,200 volts, three-phase, 60 cycle, 1800 r.p.m.	General Electric Company
2 turbines	Curtis-horizontal	25,000 kw., twelve-stage	190 lb. steam, 150 deg. superheat	General Electric Company
2 condensers	Two-pass surface	32,000 sq. ft., 255,000 lb. per hour		Westinghouse Electric & Manufacturing Company
2 exciters	Direct connected	100 kw., 250 volts compound wound	Operated as shunt machines at 1800 r.p.m.	General Electric Company
1 exciter	Shunt wound	150 kilowatts, 250 volts	Reserve equipment	Allis-Chalmers Company
1 exciter motor	Induction	220 hp., 1175 r.p.m.	Reserve equipment	Allis-Chalmers Company
2 circulating pumps	Horizontal-centrifugal	24,000 gal. per minute, 43 ft. max. hd.	Motor driven	Westinghouse Electric & Manufacturing Company
2 C. P. motors	Induction	350 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
2 air pumps	Le Blanc	37.5 cu. ft. free air per minute	Motor driven	Westinghouse Electric & Manufacturing Company
2 air pump motors	Induction	100 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 crane	Electric traveling	100 ton, 94 ft. span	2-50 ton, 1-10 ton, hooks	Morgan Engineering Company
2 air washers	Spray system	60,000 cu. ft. air per minute	Motor driven pumps, 10 hp.	Spray Engineering Company
2 oil pumps	Centrifugal	3-in. 150 gal. per minute	Motor driven	Lea-Courtenay Company
2 oil pump motors	Induction	7.5 hp.	Constant speed	General Electric Company

connecting all the emergency lighting system therewith. However, when the voltage drops below this value, this set of contactors opens, and another set instantly closes, connecting the emergency lighting system to the exciter battery. As soon as the voltage on the main lighting buses rises again, the second set of contactors opens and the first closes again. Thus the emergency lighting system insures that there will be at least some lighting throughout the station, however serious any interruption may be.

Indirect lighting fixtures are used in the control room and offices. In the control room, provision is made to connect part of the lights to the control battery in case of very serious trouble to the lighting system. The turbine room has large ornamental 500-watt tungsten bracket fixtures on the pilasters and 200-watt units on the roof trusses. The lighting effect is pleasing, as gray brick with white and green brick for trim are used on the walls. Large tungsten units are used in the boiler house.

SIGNALING AND COMMUNICATION SYSTEM

Very complete signaling and communicating systems are provided to keep the switchboard operators in close touch with the load dispatcher, turbine room and boiler house. To notify the operators in case of opening of oil switches, grounds on feeders and other operating troubles, annunciators and a bell common to all have been connected with each class of electrical equipment. The signaling system includes a switch on each generator panel in the control room controlling signals on a large illuminated sign in the turbine room and duplicate signals on the individual turbine signal stands. A turbine-room whistle is automatically sounded with each signal from the control room. On each turbine signal stand is a switch for return signals to the control room and for signaling to the pump attendant in the turbine-room basement. The operator in the control room can also indicate on bulletin boards in the boiler house the load carried by the station. An emergency alarm system is installed throughout the station to call help in emergencies. Interphone service is provided in the various offices, control room, load dispatcher's office, throughout the switch house, etc. Trunk lines connect with other important load-dispatching centers. Provision has been made for a telautograph system between the control room and load dispatcher's office to transmit switching orders and information rapidly. All station clocks and curve-drawing meters are synchronized and operated from a master clock.

Provision has been made throughout the station for a 25-volt multi-recorder system to record to one-quarter of a second the sequence of the movements of oil switches and the action of other important apparatus. The records thus obtained are expected to throw valuable light on the action of switches, relays and other equipment where records in the past have been inadequate or totally lacking.

TABLE IV—ELECTRICAL EQUIPMENT IN SWITCHHOUSE

Equipment	Type	Rating	Operating Condition	Manufacturer
Generator oil switches	O-2 double break	2000 amp., 16,500 volt	Solenoid-operated	Westinghouse Electric & Manufacturing Co.
Feeder selector oil switches	E-6	1200 amp., 25,000 volt	Solenoid-operated	Westinghouse Electric & Manufacturing Co.
Feeder oil switches	E-6	600-amp., 25,000-volt	Solenoid-operated	Westinghouse Electric & Manufacturing Co.
Switchboard panels and control	Slate, oil finish			General Electric Company
Power-service transformer oil switches	"Y"	5,000-amp., 600-volt	Solenoid-operated	Condit Electrical Manufacturing Company
Boiler-house main-feeder oil switches	"Y"	1,500 amp., 600-volt	Solenoid-operated	Condit Electrical Manufacturing Company
Branch power-service feeder oil switches	D-12	300, 500 and 1,000-amp., 600 volt	Solenoid-operated	Condit Electrical Manufacturing Company
13,200-volt disconnecting switches		15,000-volt		General Devices & Fittings Company
Switchboard instruments and instrument transformers				Weston Electrical Instrument Company
Power-service transformers		3,000-kva., 13,200–460-volt three-phase, 60-cycle	Water-cooled	Allis-Chalmers Company
Lighting transformers		200 kva., 440–250–125-volt single-phase	Self-cooled	Moloney Electric Company
Exciter battery	160-cell 15-G Exide	900 amp., thirty-minute, 250 volts	Wooden tanks	Electric Storage Battery Company
Control battery	60-cell, 11-G chloride	100 amp., eight-hour	Wooden tanks	Electric Storage Battery Company
Multi-recorder battery	12-cell, 11-G chloride	100 amps., eight-hour	Wooden tanks	Electric Storage Battery Company
4-exciter battery end-cell switches	Horizontal	1500, amps., fourteen-point	Motor-operated	Electric Storage Battery Company
1—Exciter-battery charging set	Induction motor driven	75-kw., 450-volt generator. 440-volt motor	Direct connected	Allis-Chalmers Manufacturing Company
1—Control-battery charging set	Induction motor driven	35-kw., 175-volt generator, 440-volt motor	Direct connected	Allis-Chalmers Manufacturing Company
1—Multi-recorder battery-charging set	Induction motor driven	7kw., 35-volt generator, 440-volt motor	Direct connected	Allis-Chalmers Manufacturing Company
1—Ash-handling locomotive charging set	Induction motor driven	15-kw., 135-volt generator, 440-volt motor	Direct connected	General Electric Company.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Construction of a Simple Flexible Coupling

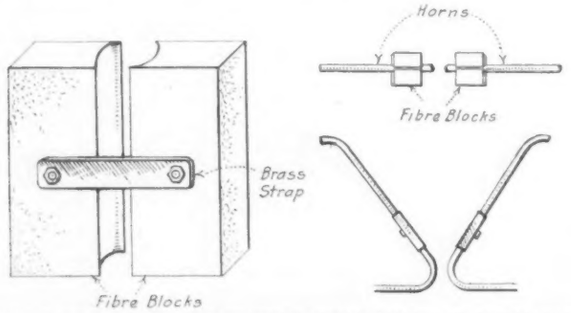
BY LEONARD A. DOGGETT

In the electrical laboratory of the United States Naval Academy at Annapolis, Md., it has been found convenient to mount a number of machines on wooden bases, which in turn are mounted on four heavy castors. When two machine sets are so mounted the lack of rigidity in the base made good alignment difficult. In the case of two 2-hp., 1000-r.p.m., 6-pole motors a special flexible coupling remedied the trouble.

This flexible coupling consisted of two perfectly plain brass disks 6 in. in diameter and 1.25 in. thick drilled to take the 1.125-in. shafts to which they were keyed. In the face of each disk, but not quite all the way through, were drilled four 0.5-in. holes 90 deg. apart. For these four holes four laminated pins, made of the ordinary electrical sheet steel, were prepared. When riveted together, they formed a bundle 5/16 in. by 5/16 in. by 2.25 in. The two motors were then lined up as closely as possible with the faces of the couplings $\frac{5}{8}$ in. apart and the laminated pins in place. In this position the motors were fastened to the wooden base by lag screws. This has proved to be a simple and satisfactory coupling.

Scheme for Preventing Birds from Grounding Lines

Two 0.5-in. horn-fiber blocks, 5 in. by 2.5 in. each, connected together by a spring-brass strap make up a device devised by T. F. Johnson, superintendent of lines, of the Georgia Railway and Power Company, to prevent small birds from being a source of trouble on transmission lines. By alighting on the horn gaps of lightning arresters, birds have grounded the lines through their bodies and caused the automatic switches to trip out in a number of cases. When the device mentioned is installed, as shown in the accompanying illustration, the heads of the bolts holding the strap are countersunk and sealing wax is poured over them. The

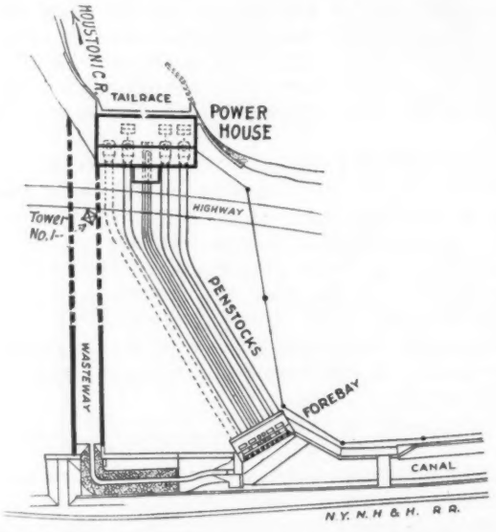


DEVICE TO PREVENT BIRDS GROUNDING LINES AT HORN GAPS

inside edges of the blocks are grooved so as to fit on the horn. By bending back the outer edges of the blocks, the inside edges are forced apart far enough to enable them to slip over the horn. On releasing, the spring strap causes the blocks to be clamped firmly on the horn. The device is placed with its bottom edge at the smallest point of the gap and with the strap on the lower side. The only part of the gap left unprotected is above the blocks, where it is so wide that no harm can be done by a bird alighting upon the horn.

Preventing Ice Troubles at a Connecticut Hydroelectric Plant

Breaking and massing of surface ice around the head gates to its penstocks have caused the Housatonic division of the Connecticut Power Company so much trouble in past years that measures have been taken recently to prevent repetition. Two methods have been em-



ARRANGEMENTS FOR DISPOSING OF ICE THAT CLOGS A FOREBAY

ployed. One is to prevent the cause and the other is to get rid of bad effects when the first method proves inadequate.

The first, or preventive, method is carried out by allowing several inches of ice to form on top of the canal (thus minimizing the formation of frazile or needle ice) and maintaining the canal level as nearly constant as possible so the ice will not break. This is facilitated by the indicating devices described on page 1007 of the Nov. 18, 1916, issue of ELECTRICAL WORLD. The second, or curative, method consists of diverting the broken ice over a spillway. While this action is assisted by the canal approaching the head gates at right angles to the penstocks, the spillway is exposed to the full impact of ice floating down the canal. Furthermore, so much ice has to be disposed of in severely cold weather that it could not be dumped at the foot of the spillway. These difficulties have been avoided to a great extent by building a structure across the forebay to skim the water entering the penstocks and to break up large pieces of ice approaching the spillway. Below this spillway has been built a concrete wasteway which discharges into the river downstream from the plant. Since a drainage tunnel had to be provided for emptying the forebay, anyway, it was extended underneath the discharge way a short distance and there connected

with the wasteway. If the ice discharged into the wasteway fails to pass on to the river unassisted, the forebay drainage gate will be opened and the velocity head secured by means of the tunnel utilized to start the ice down the wasteway.

The skimmer previously mentioned consists of slightly separated wooden strips attached to a structural-steel framework so they extent 8 ft. below the surface of the canal. The structure is installed so the waterway to the spillway converges, thus breaking up large pieces of ice by wedge action. So that the structure will withstand the pressure of ice it has been strengthened by the rods anchored in the opposite bank of the canal.

Since considerable of the frazile ice which is encountered at this plant is caused by agitation of the water at the entrance to the canal some consideration has been given to covering this part of the canal. While no definite step has been taken in this direction Superintendent J. K. Mackie believes that the largest "needle-ice factory" in the whole waterway would be eliminated by such a covering. Very little opportunity is afforded the formation of needle ice at other points as the pond above the canal is very large and deep and the surface usually covered with ice in cold weather.

Comparative Efficiencies of Motors and Steam Engines for Sugar Mill Drives

To show in a concise manner the saving that can be effected in a cane-sugar mill by using electric motor instead of steam-engine drive the Kelvin Engineering Company, Inc., New York City, has recently compiled the data given in the accompanying table. The calculations were simplified by assuming a plant with one 34-in. by 78-in. crusher and four 32-in. by 78-in. mills, the crusher and mills being driven by separate engines or motors. It should be pointed out that electric operation would show up to still better advantage if each machine were driven by an individual motor.

From the calculations it can be seen that if the mill operates the equivalent of 120 twenty-four-hour days, the total saving in steam will be $120 \times 24 \times 8500 = 24.28$ million pounds of steam. Assuming that the boilers will evaporate 6 lb. of water per pound of coal, this would mean a saving of about 2000 tons of fuel per year, to say nothing of decreased labor in handling same and ashes. As sugar mills burn bagasse, there would be an equivalent saving of bagasse. Looking at it in another light, less boiler capacity would be needed or greater output could be handled with same boilers.

Of course, if the juice heating and evaporating plant is so designed that it requires a large amount of steam, great economy in steam consumption will not be any great advantage. In any modern plant with well-designed heaters, pre-evaporators, multiple effects, pans, etc., however, no more exhaust steam would be required than could be obtained from the steam turbines.

COMPARATIVE ECONOMIES OF STEAM AND ELECTRIC SUGAR MILL DRIVES

Operating Conditions	Machine Driven	
	One 34 In. x 78 In. Crusher	Four 32 In. x 78 In. Mills
Steam engine drive:		
Type of engine	Corliss	Corliss
Speed, revolutions per minute	45	45
Indicated horsepower	158	580
Mechanical efficiency, new, per cent	90	90
Brake or developed hp	142	523
Steam pressure at throttle, pounds, gage	100	100
Steam pressure at exhaust, pounds, gage	8	8
Steam consumption, pounds per horsepower-hour	40	40
Total steam consumption, pounds per hour	7,022	25,778
Electric motor drive:		
Capacity of motor, horsepower	150	580
Efficiency of motor, at load carried	92	93
Efficiency of gearing, per cent	98	98
Brake horsepower required	14	.....
Efficiency of transmission system (wiring), per cent	98	98
Efficiency of generator, per cent	92	92
Steam consumption, pounds per horsepower-hour developed by the turbine	30	30
Horsepower developed by the turbine to supply power to motor	175	635
Total steam consumption, pounds per hour	5,250	19,050
Saving in steam consumption with electric drive (pounds per hour)*	1,772	6,728

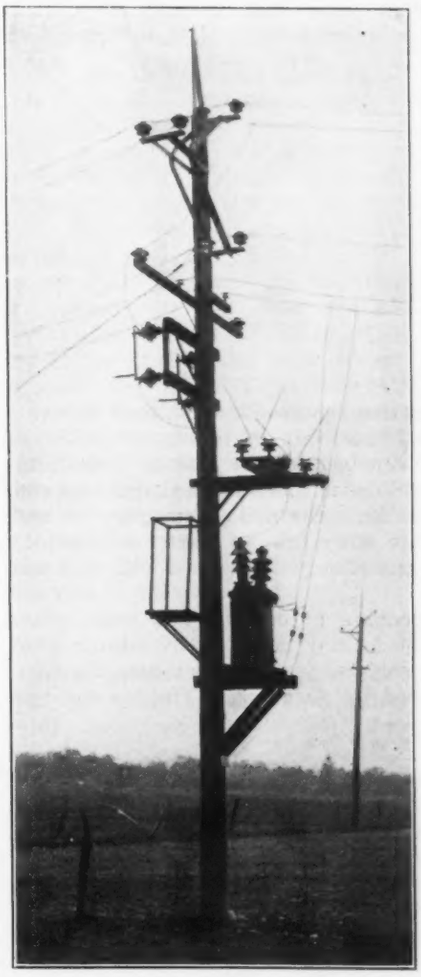
*Represents 8500 ÷ 32,800 = 26 per cent saving.

Small Individual Consumer Substations on a 33,000-Volt Transmission Line

BY M. H. WAGNER

Transmission Engineer The Dayton Power & Light Company

The Dayton (Ohio) Power & Light Company makes every effort to serve those desiring energy along its high-tension transmission lines. Farmers usually apply for service when a transmission line passes their houses. This practice on the part of the central station companies to serve individual consumers along transmission lines has caused manufacturers to develop a small transformer to give a single transformation from 33,000 to 230/115 volts that can be economically installed.



A 5-KVA. SUBSTATION ON MAIN TRANSMISSION LINE POLE

The accompanying illustration shows a one-pole, 5-kva., 33,000/230-115-volt, single-phase, 60-cycle, outdoor substation erected to serve a rural customer. No additional right of way or extra supporting structure is necessary for this type of installation, since it is installed on one of the main-line poles. In laying out the installation the aim was to make it inexpensive without cheapening it to a degree that might impair service. The disconnecting switches are of the simple design, since their only duty is to de-energize the horn-gap fuses. These horn-gap fuses were inserted to protect the transformer from overload, and it has been found best to use wire to withstand the weather. The position of the transformer with respect to the line offers

considerable additional protection, for besides the regular line conductors there is above it a No. 6 B & S copper-clad overhead ground wire. The cost of this type of outdoor substation without the transformer follows:

Iron work, lumber, etc.	$24.02
Electrical apparatus (not including transfomer)	46.30
Labor (hauling, erecting and installing transformer)	42.25
Total	$112.57

This installation has weathered the past season's severe electrical storms without difficulty other than an occasional fuse failure, which was expected. Altogether, the service rendered by this installation has been sufficiently satisfactory to warrant its being considered as standard by the company.

TREATING BOILER FEED WATER

Simple Method of Calculating Amount of Lime and Soda Ash to Use for Treating Boiler Water

Plant operators should find no difficulty in softening boiler water in an intelligent manner if the instructions given in the recent A. S. M. E. paper by Arthur C. Scott and J. R. Bailey are followed. Before explaining the method of calculating the amount of water softening chemicals to add to water, the authors pointed out that the amount of scale-forming material may serve as a basis for classifying boiler waters. For instance, less

FACTORS FOR CALCULATING WATER-SOFTENING CHEMICALS

Salt	Factor, Lump Lime, (CaO)	Factor Hydrated Lime, $Ca(OH)_2$	Soda-Ash Factor, Na_2CO_3
Sodium carbonate (Na_2CO_3)	0.529	0.699	.....
Magnesium chloride ($MgCl_2$)	0.589	0.778	1.113
Magnesium sulphate ($MgSO_4$)	0.466	0.616	0.881
Magnesium bicarbonate ($Mg(HCO_3)_2$)	0.767	1.014	.....
Magnesium carbonate ($MgCO_3$)	1.330	1.757	.....
Calcium bicarbonate ($Ca(HCO_3)_2$)	0.346	0.457	.....
Calcium carbonate ($CaCO_3$)	0.560	0.740	.....
Calcium sulphate ($CaSO_4$)	.....	.....	0.779
Calcium chloride ($CaCl_2$)	.....	.....	0.955

than 8 grains per gallon represents very good water, 8 to 15 grains good, 15 to 20 fair, 20 to 30 poor, 30 to 40 bad, and over 40 very bad. Scale due to temporary hardness in water will deposit as a loose sludge that can be readily blown off. When the ratio of magnesium and calcium bicarbonate to other salts of these two elements is less than 4 to 1 the scale will be hard and very adhesive.

If only the bicarbonate of calcium and magnesium are present their effects may be offset by adding lime alone. If the other salts are present, however, the lime must be supplemented by soda ash. The amounts of

SAMPLE WATER ANALYSIS

	Grams per Liter	Grains per U. S. Gallon
Sodium chloride	0.0744	4.339
Sodium sulphate	0.1110	6.473
Magnesium sulphate	0.3525	20.557
Calcium sulphate	0.4422	25.788
Calcium bicarbonate or Calcium carbonate	0.2535 0.1565	14.784 9.126

lime and soda ash that must be added to soften water can be obtained by multiplying the amounts of salts found by analysis by the corresponding factors in Table 1.

For example, suppose the water analysis is as shown in Table 2. Then the treatement needed for each constituent will be as follows:

GRAMS REQUIRED PER LITER OF HARD WATER

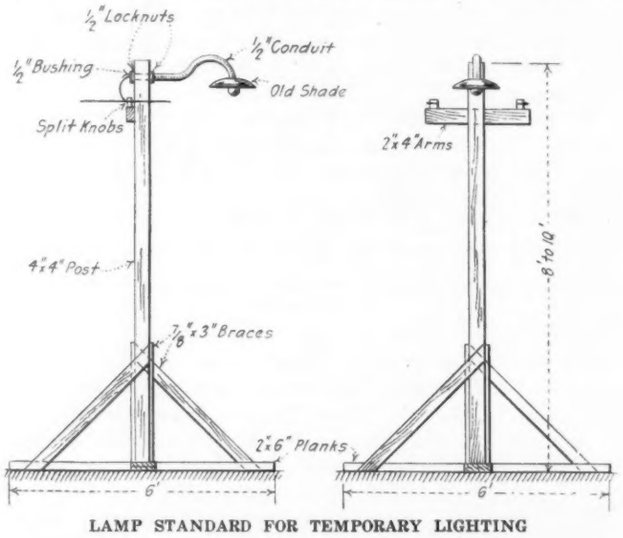
	Soda Ash	Lump Lime	Hydrated Lime
Sodium chloride	None	None	None
Sodium sulphate	None	None	None
Magnesium sulphate	0.3106	0.1643	0.2171
Calcium sulphate	0.3445	None	None
Calcium bicarbonate or Calcium carbonate	None	0.0877	0.1158
Total	0.6551	0.2520	0.3329

While the results are expressed in grams per liter, they can also be expressed in grains per gallon, parts per 100,000, or parts per 1,000,000. Since the engineer usually wishes to know the result in pounds of lime or soda ash per 1000 gal. of water it is necessary to multiply by 8.347 with grams per liter, divide by 7 with grains per gallon, multiply by 0.08347 with parts per 100,000, and by 0.008347 with parts per 1,000,000. In either the slacked or unslacked form, however, lime has only about 70 per cent efficiency due to impurities and minor combinations, therefore slightly over 40 per cent more than calculated is necessary. Soda ash is about 90 per cent efficient, so about 11 per cent more than calculated is needed. In order to avoid the cost of tankage, which the use of clear lime water would entail, it is customary to use milk of lime.

Arrangement for Temporary Illumination

BY C. B. DEAN

Lamp standards constructed according to the accompanying design have been found very satisfactory by the writer where temporary lighting had to be furnished. As shown the standard has a base consisting of crossed planks and an upright post carrying the lamp



LAMP STANDARD FOR TEMPORARY LIGHTING

and service wires. Weights of any description may be placed on the base to prevent the standard overturning. The service wires are supported by split-knob insulators carried on a small crossarm, while the lamp and shade are supported by a conduit goose neck which passes through the upright post being fastened thereto by locknuts. Connections with the lamp run through the gooseneck. A small conduit was used so it could be bent easily to direct the light on any desired spot.

Where groups of lamps could be used they have been supported from span wires strung between tall 4-in. by 4-in. posts equipped with 2-in. by 4-in. crossarms. The heights of the lamps were adjusted by changing the sag of the span wires or by adjusting the crossarms.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

INCREASING THE CENTRAL STATION'S NET REVENUE

Plans Suggested by Ohio Commercial Managers for Making the Earnings More Than Keep Pace with the Rising Costs of Coal and Copper

In opening the meeting of the Ohio new-business committee at Toledo, on Jan. 18, F. R. Coates, president of the Toledo Railways & Light Company, offered the suggestion that consideration should be given to means for increasing central station companies' revenues sufficiently to offset the constantly rising cost of operation. This subject is particularly important at this time, said he, when utility companies which are prohibited from raising their rates find themselves confronted by increased prices in all of the commodities they buy. Although the discussion which followed did not dwell exclusively on that point, several ideas which bear directly on that topic were brought out. They are given in the following paragraphs:

E. T. Hollingsworth of Newark, Ohio, expressed the belief that an appliance or appliances should be sold with each job of house wiring. There are several advantages in this practice; it is easy to add $5 or $10 worth of appliances to a house-wiring contract because the amount is not large in comparison to the total and because the salesman who has his prospective customer at the point of signing a house-wiring contract already has won confidence and can advise the purchase of appliances in a manner that will impress the purchaser with the salesman's sincere interest in his household problems. The plan has the further advantage of accustoming the customer from the very beginning to bills which include energy used for purposes other than lighting; it turns the minimum-bill customer into a profitable patron; and it assures the use of more energy on the first and highest step of the rate schedule.

In order to learn how much appliance business is being done with the present method of selling, J. E. North of Springfield, chairman of the meeting, asked for reports on 1916 appliance sales. Representatives of four cities, namely Springfield, Youngstown, Toledo and Massillon, responded. From these reports it was learned that the total population of the four cities was about 406,000; the total meters installed was about 59,000; and the total number of appliances sold was about 18,000. It may, therefore, be calculated that in these four cities in 1916 there was sold one appliance for every 22.5 people or one appliance for every 3.3 lighting customers. Opinions expressed as to the revenue derived from appliances indicated that some believed they would return as much as $7 per kilowatt per year, while others believed the return might be as low as $3.50 per kilowatt per year. It was agreed that electric irons return from 30 cents to 40 cents a month.

G. H. Mau of Coshocton said his company, which has a heavy power load as compared to its lighting load, expects to increase its net revenue in 1917 by studying the load curve of the system and striving to add new business which will fall in the valleys of that curve. Attempts to smooth out the peaks of the curve will also be made by offering certain industries attractive contracts if they will perform operations requiring large blocks of power during off-peak hours. Grain grinding, coal cutting and industrial heating will be the principal businesses in which this plan can be worked out.

In speaking of the effect of industrial electric heating load on the central station company's business, H. S. Kuntz said the experience of the Toledo company had been that it increased not only the load factor but also the power factor of the entire system. In addition to this the electric heating business has produced a satisfactory merchandising profit and an income from energy which when considered on the kilowatt-year basis is not to be despised.

CHANGING FROM FLAT RATE SERVICE TO METERED BASIS

Legitimate Uses of Service Equally Well Cared for in Sacramento, Cal., After Reducing Energy Consumption by 42 Per Cent

In 1913 the Sacramento district of the Pacific Gas & Electric Company made an inventory of the quantities of electrical energy consumed and the uses to which it was applied in the territory served from the Sacramento substation. It was decided as a result of this examination that a large percentage of the current actually distributed in the district was not accounted for in the consumers' monthly accounts as carried on the company's books. At that time a flat-rate basis for residence lighting was in effect, the usual rate being $2 per month for each ten-socket installation and 15 cents each for all additional outlets.

It was decided that a large part of this non-productive current could be saved by the installation of meters, and that it would at the same time be possible to keep the consumer entirely satisfied with conditions by teaching him how to use metered service effectively. Accordingly, after giving due notice of the new schedules, the system was gradually changed over from flat rate to metered basis.

CUSTOMERS BETTER SATISFIED

When first announced there was much dissatisfaction with the meter basis. The consumers feared their bills would be higher than on the flat rate and the company found it necessary to give constant and careful attention to complaints in order to effect the change and at the same time keep the customers satisfied. The plan was entirely successful, however, and now that the change to a meter basis is practically completed, the district manager recently said, "I venture to say that between 80 and 90 per cent would not go back to the flat rate for the reason that their bills are considerably less on meter and at the same time they are receiving all the necessary service for less money." When the campaign was begun, 26 per cent of consumers were on a metered basis. After 86 per cent of the total number of consumers had been put on a metered service basis the consumption per consumer was 42 per cent less than it had been at the outset.

In the early stages of this campaign all manner of arguments were brought up to discourage and prevent

the company from putting in the meters. For example, under the flat-rate basis it was the custom to burn porch lights in the residence districts all evening, and when the installation of meters was proposed the objection was advanced that the residence district would be darkened to a great extent and this attractive feature for which the city had become noted would disappear. In answer to this objection the company pointed out that by the use of a 10-watt Mazda lamp practically the same effect could be secured and the cost per month would be insignificant. In order to demonstrate its good faith on this point and meet the consumer halfway, the company in many cases supplied these 10-watt lamps gratis.

ECONOMIES IN LIGHTING

The same possibilities for economies were pointed out to the consumer in his interior lighting. For example, that he should use lamps of low capacity in halls and bathrooms and wherever a high intensity of light was not required. In fact, with the proper selection of interior units the majority of the consumers were able to have their homes lighted in an even better way than before, while the cost was no more than it was on the flat-rate basis.

Meters installed for checking purposes on the lines of consumers whose flat-rate contracts had not yet expired, developed some remarkable cases of excess use of current. It was not uncommon to find a rooming house on a $2 to $2.50 monthly rate heating rooms by electricity, in some cases using current continuously during cold weather. In one instance a consumer who was paying $8.25 for light was shown by the test meter to be using, on the lighting rate, $324.65 worth of electricity per month. In another case, a rooming house with three electrically heated rooms, the flat rate was $2.15 for the eleven outlets on the official record. The test meter, however, showed that the actual consumption was $94.25 worth of energy per month.

COMPANY'S INCOME ACTUALLY REDUCED

Since the installation of meters the total income from the sale of energy has been considerably reduced, thus proving the company's contention that it would be cheaper for the consumer. However, the company has profited by the more than proportional reduction of energy consumption. Before installing the meters whenever an interruption occurred on the transmission lines, it was impossible to carry the district load on the steam-station system even if service was confined to the downtown district, street-car system and part of the residential district. Under the reorganization of the service, whenever interruptions occur in the transmission lines, it is now possible to carry the entire load from the local steam standby station.

Tools in Automobile Factory Tempered Electrically for 1.57 Cents Each

The following data on the cost of treating steel tools electrically was obtained in one of the large automobile manufacturing plants. The table showing the exact test readings is given herewith. From these data it will be observed that the electric tempering furnace was operated 98.5 hours on nineteen days, or an average of 5.18 hours per day. In that time 1978 high-speed steel tools of various types were treated. The cost of energy for hardening these tools, with energy at 3 cents per kilowatt-hour, was $26.63. Adding to the cost of energy the cost of renewing carbon-heating elements, which was $4.48, the total cost of operation for the period was $31.11. The cost of treating each tool was, therefore, 1.57 cents.

The weight of the tools was not taken on any except the last five runs. In these the total weight of tools treated was 352 lb., and the cost per pound of treating the tools in the last five runs was 2.33 cents per pound. All of these tools were treated in a Hoskins type FC-204 electric furnace, the internal dimensions of which were 6.5 in. by 5 in. by 11 in. The maximum rating of the furnace is 15 kw., but in treating high-speed steel such as these tools were, with which temperatures of 2100 to 2300 deg. Fahr. are required, the average demand is between 9 kw. and 10 kw.

The reason an electric furnace was selected by this manufacturer for treating tools was that it produces uniform and controllable temperature and permits control of the furnace atmosphere. These factors are important in tool work, because the efficiency of a metal-working machine varies directly with the efficiency of the tool with which it is equipped. Moreover, a variation of 50 deg. Fahr. from the proper temperature in treating certain grades of steel tools will produce a difference of from 30 per cent to 70 per cent in the life of the tool. Advocates of electrically treated steel point out that since the electric furnace permits of accurate

DATA ON TOOLS HARDENED AND COST OF ENERGY FOR ELECTRIC FURNACE

Current On	Current Off	Hours Run	Circular Cutters	Reamers	Shell Reamers	Reamer Blades	Keyway Cutters	Taps	Circular Form Tools	Thread Chasers	Profile-Cutters	Pointing Tools	Tools for Tool Stock	Hollow Mills	Total Tools Hardened	Cost of Energy Used	Cost of Energy per Piece	Weight of Tools Hardened Weight in Pounds	Cost of Energy per Pound
12:30	5:30	5	15	3	3	78	....	....	....	....	....	....	....	....	99	$1.35	0.0136	.....	.....
12:30	7:00	6.5	4	6	18	....	12	25	4	19	12	9	....	....	109	1.76	0.0161	.....	.....
12:30	5:30	5	....	22	18	....	....	3	1	....	....	12	....	....	56	1.35	0.0241	.....	.....
12:30	4:30	4	3	8	18	....	....	8	4	....	....	....	6	....	47	1.08	0.0229	.....	.....
10:00	5:30	6.5	1	9	....	323	....	....	2	....	....	....	....	....	335	1.76	0.0052	.....	.....
12:30	8:00	7.5	11	20	18	67	....	....	11	....	....	....	....	....	127	2.03	0.0160	.....	.....
1:30	5:30	4	1	8	12	68	....	....	3	....	....	....	....	....	92	1.08	0.0117	.....	.....
3:30	5:30	2	....	....	....	2	....	....	5	....	....	6	8	....	21	0.54	0.0257	.....	.....
12:30	7:30	7	24	....	36	54	....	1	1	....	....	3	19	....	138	1.89	0.0128	.....	.....
1:00	5:30	4.5	....	....	12	96	....	....	12	2	....	....	....	....	122	1.22	0.01	.....	.....
12:30	6:30	6	5	....	....	150	28	5	3	5	....	....	....	1	197	1.62	0.0082	.....	.....
1:00	5:00	4	....	....	....	....	9	12	3	5	....	....	....	....	29	1.08	0.0372	.....	.....
7:00	11:00	4	....	....	....	48	....	....	4	11	....	....	....	1	64	1.08	0.0153	.....	.....
12:30	7:00	6.5	2	64	....	41	....	2	3	3	....	24	....	12	151	1.76	0.0116	.....	.....
1:30	6:30	5	27	5	....	....	....	....	4	....	....	4	....	8	48	1.35	0.0281	110	0.0122
12:30	6:30	6	70	12	....	13	2	....	6	....	5	....	....	9	117	1.62	0.0138	100	0.0162
12:30	7:00	6.5	56	....	....	13	....	....	2	....	6	3	....	18	98	1.76	0.0179	80	0.0220
2:00	5:30	3.5	2	4	....	....	....	....	8	8	12	6	....	6	46	0.95	0.0208	26.5	0.0358
1:00	6:00	5	....	....	....	4	44	....	7	....	....	24	....	3	82	1.35	0.0164	35.5	0.0380
Total.....	.....	98.5	221	161	135	957	95	56	83	53	35	91	33	58	1978	$26.63	.....	352.0	.....

temperature control, it is frequently more economical to treat tools electrically than by other methods even if the other methods are apparently less expensive.

While these data were received from the plant of a large manufacturer, furnaces of this type have found practical use in plants so small that all of the tools can be treated by operating the furnace one day a week.

"One-Minute Service Chats" with the Customer

The Union Electric Light & Power Company has been running a series of "One Minute Service Chats" in the St. Louis newspapers, discussing in friendly fashion and in easy language the relations of the central-station company with its customers and public, and outlining some of the problems of electric service which the customer does not always realize. One of the best of this educational series was the advertisement reproduced herewith, which points out how the small user, despite the fact that he pays a higher rate, may be really a less profitable customer for the company to carry than is the low-rate business of the large user taking many kilowatts during long-hour periods. Advancing the argument a step further, any possible objection on the part of the large customer to this proportioning of costs is finally met by reminding the reader that each new customer means ultimately lower rates for all customers of the central-station, both large and small.

ONE-MINUTE ELECTRIC SERVICE CHATS

Our Favored Customers

In most lines of trade, prices are fixed by two factors—cost to the seller and value to the buyer.

These factors help fix electric service costs. But there's a third factor just as important.

This third factor is the central station's need to encourage the use of electric service by more customers, for more different purposes, more hours a day—in order to get more use of the big plant investment.

This third factor shades the other two. Central stations as a rule aim to get from each customer at least the actual cost of serving him. When we do that, no customer can complain that he has to help pay the other fellow's bill.

Most of you, very likely, think we make our money off the customers who pay us the highest primary rate per kilowatt hour. These are our residence customers, most of whose bills average $1.00 to $2.50 per month.

We don't. These are our favored customers. They get service closer to actual cost than any others on our books. Central stations are serving a great many of them at an actual loss.

That loss is a necessary part of the cost of building up new business. Each year most of these customers use more service, for more different purposes, more hours a day, thereby earning lower rates and, by increasing the whole volume of the company's business, helping to earn lower rates for all other customers.

Such profit as central stations earn is got chiefly from big customers using large quantities of energy a good many hours a day, at automatically earned rates.

These big customers might complain that they have to help pay the small customers' bills. They don't complain, because they understand that each new customer ultimately means lower rates for all customers, and that the service has been sold to them strictly on its merits and on the basis of its value to them.

(Copyrighted)

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust Branches: 4912 Delmar, 3028 N. Grand 3012 S. Grand

A CHAT CONCERNING RATES AND COSTS

The small user, the central station's favored customer, obtains his service closer to actual cost than even the wholesale user with his lower rate

"WIRE-YOUR-HOME-TIME" FROM APRIL 1 TO MAY 15

Society for Electrical Development Offers $1,250 in Prizes for Largest Number of Contracts Obtained During Six-Month Period

The Society for Electrical Development has announced cash prizes totaling $1,250 in connection with its annual spring house-wiring drive set this year for the period from April 1 to May 15. The contest is open to all house-wiring contract salesmen employed by central stations or contractors.

The country will be divided for campaign purposes according to population so that cities and towns of nearly equal size will have equitable chance of competition. Under the plan as arranged the prize money will be divided equally between five classes:

1. Cities of 15,000 or under.
2. Cities of between 15,000 and 50,000.
3. Cities between 50,000 and 100,000.
4. Cities of between 100,000 and 500,000.
5. Cities of 500,000 and over.

The highest prize for each group of cities, going to the solicitor who can show the largest number of contracts secured between April 1 and May 15, will amount to $150. There will be a second prize of $50 for each group; also five additional prizes of $10 each.

The $1,250 prize campaign will be one of the main features of "Wire-Your-Home-Time," advance details of which were worked out by the society's special house-wiring committee which met on Jan. 18, at the society's offices in New York.

The committee decided to extend the time of this year's campaign to six instead of four weeks, as last year. This was done in order to give all sections of the country, both North and South, an equal opportunity to profit by local weather conditions. The extension of the season necessitated changing the name from "Wire-Your-Home Month," last year's title, to "Wire-Your-Home-Time."

The society will issue a preliminary broadside announcing that the purpose of the campaign is to secure the co-operation of the entire industry in obtaining more outlets for electric service during one of the most active periods of the year. Following this there will be issued a "How To" handbook for the trade giving suggestions for putting on local campaigns, suggested sales display and advertising helps.

It is stipulated that for the purposes of the campaign a contract shall be defined as a "new contract for at least three rooms with four sockets or outlets, or over, in a house already built." The contestant makes affidavit that each contract secured conforms to those conditions, and reports must be mailed not later than May 16 to receive consideration.

All reports should be addressed the "Wire-Your-Home-Time" Contest Committee, Society for Electrical Development, 29 West Thirty-ninth Street, New York.

The "Wire-Your-Home" campaign committee consists of: G. M. Sanborn, chairman, Sanborn Electric Company, Indianapolis, Ind.; E. W. Lloyd, Commonwealth Edison Company, Chicago, Ill.; A. L. Oppenheimer, Enterprise Electric Construction Company, Cleveland, Ohio; H. C. Heidrich, Electric Motor & Repair Company, Newark, N. J.; T. J. McManis, Edison Lamp Works, Harrison, N. J.; Elliott Reid, Westinghouse Lamp Works, New York; N. H. Boynton, National Lamp Works, Cleveland, Ohio; E. W. Rockafellow, Western Electric Company, New York; Robert Montgomery, Louisville (Ky.) Gas & Electric Company; M. S. Seelman, Jr., Edison Electric Illuminating Company, Brooklyn, N. Y., and J. M. Wakeman, general manager and H. W. Alexander, director of publicity of the Society.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

RECEPTION OF CABLE SIGNALS

Application of Detectors Commonly Used in Radio-Telegraphy—Results with Ticker and Audion Amplifier

BY LOUIS W. AUSTIN AND LOUIS COHEN

THE possibility of applying radio-telegraphic methods for the reception of cable signals was suggested to the writers some time ago by Col. G. O. Squier. Acting on this suggestion, a series of laboratory experiments has been arranged to test out the possibilities of the various detectors commonly employed in radio-telegraphy. It was soon found that the ticker and audion, the most sensitive detectors for high frequency currents, are also suitable as detectors for low frequency and direct currents.

The function of the ticker is simply to interrupt the current a large number of times per second producing an audible note, which is then detected in an ordinary telephone associated with it in the usual way. An audion amplifier may be also interposed through trans-

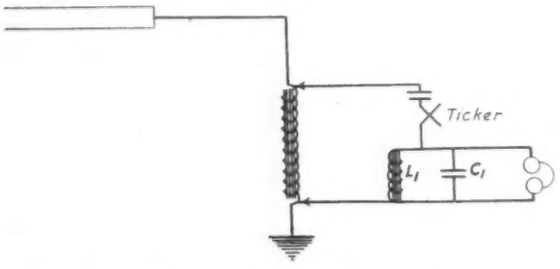


FIG. 1—CONNECTIONS FOR RECEIVING CABLE SIGNALS BY MEANS OF TICKER

formers between ticker and telephones, and thus greatly amplify the signal. In either case it was found that a high degree of sensitiveness was obtained. We have made use of the slipping contact ticker which was employed before for similar purposes, as described by L. W. Austin in the *Physical Review*.

Several circuit arrangements which more or less simulated cable conditions were soon tried, and the results obtained were sufficiently encouraging to warrant undertaking tests on a cable. Through Colonel Squier's interest in these experiments permission was obtained from the Signal Corps, U. S. A., to carry on tests on the government Alaskan cable. This cable extends from Sitka, Alaska, to Seattle, Wash., and is 1086 miles long. The electrical constants of the cable are: $K = 0.45$ mf. per mile and $R = 7.0$ ohms per mile, and the KR value of the cable is almost the equivalent of a trans-Atlantic cable. Figs. 1 and 2 show circuit arrangements.

In one case where the ticker alone is employed the interrupted current of the received signal is directly audible in the telephones, while in the other cases, the arrangement shown in Fig. 2, an audion amplifier is introduced to further increase the sensitiveness. In either case to get the best results it was found necessary to use the reversal method. The simple Morse code was used, and the sending key so arranged that for every successive signal the current was reversed.

The inductances and capacities of the circuits marked L_1C_1 and L_2C_2 are adjusted to be in resonance for the frequency of the interruptions produced by the ticker. With the arrangements of the circuits shown in the

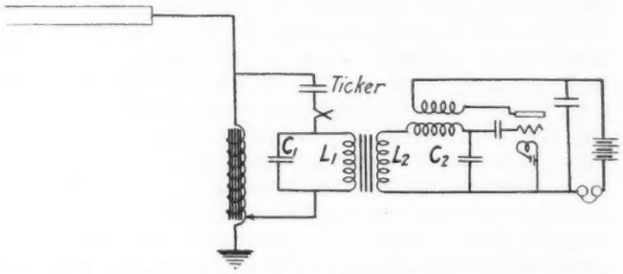


FIG 2.—CONNECTIONS FOR RECEIVING CABLE SIGNALS WHEN AUDION AMPLIFIER IS USED WITH TICKER

diagrams a remarkable degree of sensitiveness was obtained. One dry cell at the transmitting end was sufficient to produce clear signals.

This method of receiving cable signals is applicable to the Squier system of cable telegraphy, where an unbroken alternating current is used, as well as to Morse signals by the reversal method.

Generators, Motors and Transformers

Strap Field Windings.—R. H. WILLARD.—Copper strap is often used for winding fields of large current capacity. Where the strap is so thin that it is not rigid enough to support itself, it is wound flat and insulated between turns with asbestos tape, as illustrated in Fig. 3. This is a rugged construction mechanically, making it good for applications such as railway motors, where

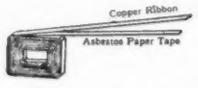


FIG. 3—METHOD OF WINDING AND INSULATING STRAP

vibration and mechanical service are very severe. This coil is practically heatproof, but it does not radiate heat as well as the edge-wound coil shown in Fig. 4. In this coil the strap is wound on edge and insulated with asbestos strips cut to shape and cemented in place with shellac. After the coil is completely wound it is

FIG. 4—COIL WITH STRAP WOUND ON EDGE AND INSULATED WITH ASBESTOS STRIPS

pressed down in a steel frame and all the inflammable material burnt out with a gas flame at a considerable temperature, leaving a coil which is almost indestructible by heat. Since the edges of the strap are bare, this type of coil radiates heat well. In large machines where the series field is quite heavy, strap may be wound

on edge with simply an air space between turns for insulation. The turns are separated at intervals by wooden or fiber separators bound in place. In this type of coil the copper is entirely exposed to the air, thus

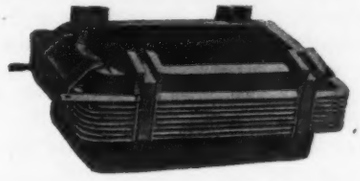


FIG. 5—COPPER IN THIS COIL ENTIRELY EXPOSED TO AIR

securing the maximum heat radiation, as shown in Fig. 5.—*Electric Journal*, January, 1917.

Lamps and Lighting

Luminous Efficiency of the Radiation from the Electric Arc.—ENOCH KARRER.—An account of an investigation carried out in the laboratory of the United Gas Improvement Company of Philadelphia. For determining the luminous efficiency one has to determine the total radiation and the radiation through the "luminosity" screen. In doing this for arc lamps there is to be met the difficulty of continuous variations in the arc.

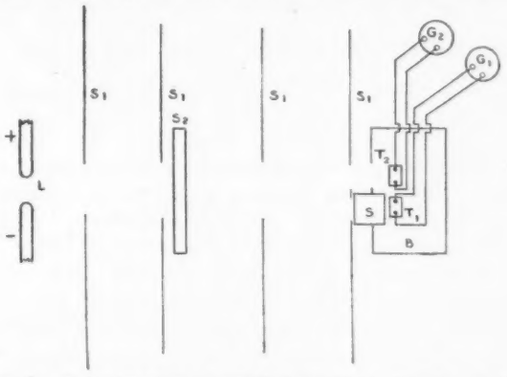


FIG. 6—DIAGRAMMATIC SKETCH OF THE SET-UP OF THE APPARATUS

In the present author's method this is overcome by providing a duplication of apparatus so that two thermopiles are available, two sensitive galvanometers, and two observers so as to record approximately simultaneous conditions of the light sources as to its radiation with and without the luminosity screen. The arrangement is shown in Fig. 6. L is the light source studied; S_1, screens; S_2, double-walled shutter; B, sheet-iron box

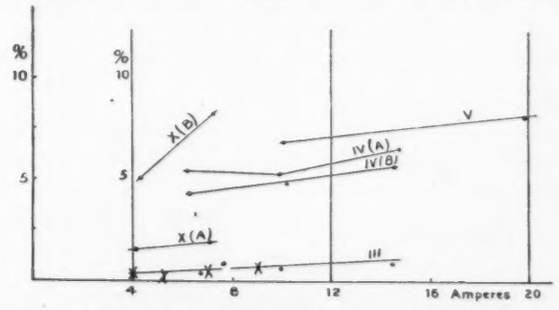


FIG. 7—CURVES SHOWING RELATIONSHIP BETWEEN LUMINOUS EFFICIENCY OF RADIATION FROM AND CURRENT THROUGH THE ARC

inclosing thermocouples T_1 and T_2; S, cell containing the luminosity solution. The thermocouple T_1, together with the galvanometer G_1 constitute radiometer I and the thermocouple T_2, with galvanometer G_2, constitutes radiometer II. Some of the results are shown in Fig. 7, which shows the relationship between the luminous efficiency of the radiation from and the current through the arc. Curve III refers to solid carbon electrode, IV, V to yellow flame cored carbons, VI, VII, VIII and IX to yellow and white flame homogeneous carbons, X to magnetic electrodes.—*Journal Franklin Inst.*, January, 1917.

Generation, Transmission and Distribution

Car Handling on Ore Docks.—CHARLES E. COLE.—The author discusses the use of rope haulage versus electric locomotives and points out the various advantages of electric locomotives.—*Elec. Journal*, January, 1917.

Steam Turbines on Ship Board.—W. J. DAVIS, JR.—The unprecedented demand for more cargo ships has vigorously raised the question as to what form the power plant shall take—reciprocating engines, direct-connected turbine, or turbine with reduction gears. In this article certain limitations of the first two forms for cargo ships are pointed out, and the merits of the turbine reduction-gear drive are explained. The construction and arrangement of Curtis "ahead" and "astern" turbines with Alquist reduction heats is described and illustrated.—*Gen. Elec. Rev.*, January, 1917.

Installations, Systems and Appliances

Large German Electric Central Station.—Work at the Golpa-Lessenitz lignite deposits and the large electric central station which is to be supplied with fuel from these deposits has been somewhat retarded on account of underground water and unfavorable weather. The power station has a capacity of 180,000 kw. The concern belongs to the Berlin Electricity Works. While the work is going on energy has been generated mostly by means of fuel from other sources. During the last year efforts have particularly been aimed at supplying as soon as possible the current necessary for the Bavarian Nitrogen Company and the Electro-Saltpetre Company (making nitric acid from air for military purposes). The contract with the latter concern, which is located in the vicinity of the power station, is for 240,000,000 kw.-hr. annually. The station began work in December, 1915, with a continuous load of 15,000 kw., which by the end of the financial year, June 30, had risen to 25,000 kw. The current year also will be marked by continued construction and a gradual increase of the energy generated.—London *Electrician*, Dec. 22, 1916.

Electrophysics and Magnetism

Characteristics of Iron in High-Frequency Magnetic Fields.—RALPH BOWN.—Formerly it was quite generally believed that iron was unable to follow rapid magnetic changes. Experiments which showed an apparent decrease in the permeability of the iron with an increase in the frequency of the magnetic cycle furnished a basis for a theory that iron was magnetically sluggish. Further and more accurate experiments proved, however, that the effects which had previously been ascribed to a peculiarity of the material were in reality caused by eddy currents in the sample. Theoretical calculations were made which demonstrated that eddy currents in an iron test piece increased as the square of the frequency, and that for even the lower frequencies it was necessary to use quite thin laminations in magnetic circuits in order to eliminate deleterious effects. Furthermore, it was found that due to eddy currents and the magnetic properties of iron, the magnetization in high-frequency fields was confined to a thin surface layer of the piece. This "magnetic skin effect" reduced the cross-section of the iron which was magnetically active even though the laminations were extremely thin. Careful experimental measurements

compared with theoretical calculations proved that the real permeability of iron remained unchanged at frequencies up to about 10^8, and that previous results had been in serious error due to neglect to the factors mentioned. This fact having been established, efforts were made to see what practical use could be made of iron in high frequency work, and to that end some extensive experimental investigations of the saturation curves and core losses were made upon specimens laminated as thinly as was commercially practicable. It is a demonstrated fact that the permeability of all metals is unity for the magnetic cycles imposed upon them by heat and light waves. In the region between frequencies of about 10^8, where the true permeability of iron is practically the same as at zero frequency, and frequencies of about 10^{10}, where the true permeability of iron approaches unity, the experimental value of μ decrease smoothly with the frequency. What happens to μ in the range of frequencies between the longest heat waves and the shortest Hertzian waves which have yet been made is a question which has many interesting features but which has not yet yielded to the experimenter.—*Journal Franklin Inst.*, January, 1917.

Electrophysics and Magnetism

Relation of Dielectric Losses in Condensers to the Conditions of Charge and Conduction.—F. TANK.—An abstract of a long paper in *Annalen der Physik*, Vol. 48. The author describes various methods of measuring directly the losses in condensers exposed to an alternating electric field, and studies their quantitative relation with the conditions of charge and the conductivity of the dielectric. Among the phenomena characteristic of charged condensers, the existence of an "after-charge" current, following the normal charging current, deserves attention. As regards the effect of conduction through the dielectric, it is to be noted that there is no constant current corresponding with a constant electric field, and that the current diminishes with time. The two phenomena are so far distinct that, in general, the first only exhibits itself in the case of solid dielectrics, and the second in the case of liquid dielectrics; it is, however, possible that the two effects may overlap to some extent. The first effect is explicable according to the Schweidler-Wagner theory of dielectric "after-action," the second is based on ionic conduction. This after-action exhibits proportionality with the intensity of field and also "reversibility"; the calculation of these losses with alternating currents on a theoretical basis is therefore possible. The conduction effects, on the other hand, are not reversible; in an alternating field they merely give rise to a purely heating loss. These considerations are confirmed by our knowledge of the course of the phenomena during a small interval of time. While during a small interval a constant conductivity is observable in the case of liquid dielectrics, we find with solid dielectrics that the shorter the period of time the greater the momentary after-charge current appears to be, without any recognizable limit being apparent. The loss in alternating fields may exceed that due to stationary conditions by more than a hundred times. Since this loss increases with the frequency (being approximately proportional thereto), it follows that at high frequencies condensers using solid dielectrics exhibit losses far greater than those with liquid dielectrics, even though at a low frequency the reverse may be the case. A comparison of theoretical data with the results of actual experiment shows that the losses in solid dielectrics must be ascribed almost entirely to this after-affect in the dielectric. Apart from the relatively small losses that arise from a certain degree of conduction being present, there is no evidence of losses arising simply through the alternation of the field, such as, for example, the absorption of electric oscillations in the dielectric, analogous with those which occur in connection with dispersion phenomena in many liquids. These effects occur at such exceedingly high frequencies as to be comparable with intramolecular processes, and are not met with in practice with ordinary alternating currents. It appears, therefore, that the losses encountered are of quite a different character, and when described in terms of "dielectric after-effect" or "viscous hysteresis" these expressions should not be allied with any special conception in molecular physics.—London *Electrician*, Dec. 8, 1916.

Electrochemistry and Batteries

Brittleness Produced by Electroplating.—M. DEKAY THOMPSON and C. N. RICHARDSON.—Spring steel becomes brittle when used as cathode in a hot cyanide solution, either sodium cuprocyanide or simply sodium cyanide. The effect is more pronounced with the simple salt. Brass and phosphor bronze are not affected. The authors tried to find the reason for the brittleness, but have not yet found the explanation of the effect. It is not caused by the liberation of hydrogen nor is the carbon content or the crystalline structure changed by electrolysis.—*Met. & Chem. Eng'ing*, Jan. 15, 1917.

Units, Measurements and Instruments

Electric Units and Standards.—A pamphlet of sixty-eight pages. The first chapter deals with the system of units (units and standards in general, the electrostatic and electromagnetic systems, international electric units). The second chapter sketches the evolution of the present system of concrete standards. The third chapter deals with units and standards of the principal electric quantities (resistance, current, emf., quantity of electricity, capacity, inductance, power and energy, resistivity). The fourth chapter deals with magnetic units. There are four appendices on conversion factors, legislation on electric units, bibliography, and symbols.—*Circular, Bureau of Standards*, No. 60, Sept. 25, 1916.

Telegraphy, Telephony and Signals

Telegraphs and Telephones in British Colonies.—R. W. WEIGHTMAN.—The first two sections of a long paper read before the (British) Institution of Electrical Engineers. After referring to British post-office practice, the author deals with the appointment of engineers, with working staffs and sources of supply. He then considers telegraph and telephone administration in the crown colonies, and amalgamation of railway telegraphs with postal telegraphs. The next section of the paper is devoted to overhead construction. The telegraph and telephone systems of the crown colonies—South Africa, Canada, Australia and New Zealand—are described at some length, and in conclusion the important question of lightning protection is considered. The paper is to be concluded.—London *Electrician*, Dec. 15 and 22, 1916.

Miscellaneous

Discontinuance of British Electrical Journal.—"After exactly ten years of weekly publication, *Electrical Engineering* is forced to take leave of its readers. Like so many other enterprises in these difficult times, we have struggled hard against adverse circumstances. One by one, however, we have seen the members of our staff taken from us for military duties, and the proprietors at last find themselves obliged to close down while their newspaper is at the height of its popularity."—London *Elec. Eng'ing*, Dec. 28, 1916.

J. Grant De Remer has opened an office for general consulting practice at 55 Liberty Street, New York, where he will carry on the engineering work formerly handled by the firm of Martin & De Remer, 100 Broadway.

A. C. Martin, formerly commercial manager of the Rockford (Ill.) Electric Company, has been appointed manager of the Steubenville district of the Ohio River Power Company, a subsidiary of the American Gas & Electric Company.

J. E. Davidson, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., and one of the best-known utility men in the country, will resign from the Portland company to assume new and important duties with the Electric Bond & Share Company in New York. Mr. Davidson became associated with the Pacific Power & Light Company more than six years ago in the capacity of commercial manager. He was formerly with the public utility companies at Port Huron, Mich., and served as secretary-treasurer of the Michigan Electric Association. Later he became president and manager of the Consolidated Lighting Company of Montpelier, Vt. He was president of the Vermont Electrical Association in 1909 and president of the New England Section of the N. E. L. A. in 1910-1911. Since going to the Pacific Coast he became president of the Northwest Electric Association in 1911-1912, was elected a member of the executive committee of the National Electric Light Association at the San Francisco Convention in 1915, and chairman of the Portland Section of the N. E. L. A. in the same year. He is at present chairman of the executive committee of the Northwest Electric Association, and is still a member of the executive committee of the National Association, besides being on a number of committees. As vice-president of the Pacific Power & Light Company Mr. Davidson was in charge of matters of engineering, new business, purchasing, taxes, stores, maintenance and operating. His popularity on the Pacific Coast is as great as in New England and in Michigan, and his removal to New York will be felt as a loss by managers in the Northwest.

J. E. DAVIDSON

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Frederick O. Eaton has been promoted to be general manager of the Rumford Falls Light & Water Company of Rumford, Me.

D. P. Tierney has been appointed superintendent of the Sayre (N. Y.) Electric Company, with which he has been connected for the past eight years.

G. M. Dahl has resigned as vice-president of the Electric Bond & Share Company, New York City, to become vice-president of the Chase National Bank of New York City.

L. A. Ferguson, vice-president of the Commonwealth Edison Company, Chicago, has been elected a director of the Civic Industrial division of the Chicago Association of Commerce.

George E. Willard has been appointed electrical superintendent of Quakertown Borough, Quakertown, Pa., succeeding T. B. Taylor, formerly electrical superintendent of the borough.

Martin J. Wolf has been appointed vice-president of W. N. Matthews & Brother of St. Louis, Mo. Mr. Wolf has been connected with the St. Louis firm since April, 1914, when he joined its staff as jobbing sales manager. As statesman-at-large and as chairman of the "100 Point" committee Mr. Wolf's work in the Jovian order has attracted wide attention.

Stanley P. Farwell, for two and one-half years chief of the service division of the State Public Utilities Commission of Illinois, has left the commission to join the engineering staff of Arthur Young & Company, Chicago. Mr. Farwell was graduated in electrical engineering from the University of Illinois, and after some time in central station work became an instructor in engineering subjects, first at the Central University of Kentucky, and later at the University of Illinois. At Illinois he also carried on post-graduate studies and the degree of Ph.D. was conferred upon him in 1914. While with the commission he organized and supervised the work of the service division and aided in formulating the commission's service rules and its rules for overhead electrical construction.

Obituary

John B. Sullivan, president of the Ashland (N. H.) Electric Light Company, is dead at his home in Ashland. He was born at Holderness, N. H., fifty-eight years ago.

Brother Potamian (Dr. Michael Francis O'Reilly), professor of physics at Manhattan College, New York City, and author of many scientific articles and books, died on Jan. 20. He was born in 1847 in County Cavan, Ireland, and received his education in London, Montreal and New York, earning the degrees F.S.C. and D.Sc. After teaching in Quebec and St. Louis he was sent to London in 1870, where he remained for twenty-three years on the staff of the Brother's College of that city. In 1893 he was given charge of the courses in mathematical and experimental physics at De LaSalle Normal College at Waterford, and three years later he was chosen to direct the same courses in Manhattan College. Besides numerous articles in the engineering and scientific press, Brother Potamian was the author of "Gleanings in Electrical History," "Franklin and DeRomas on the Lightning Kite," "The Weight of the Earth," "The Rotation of the Earth," "The Electrical Work of Benjamin Franklin," and others. He was also joint author of "Electrical Illumination," "The Makers of Electricity," "The Makers of Astronomy," and the "Catalogue of the Wheeler Gift" presenting a brief history of works on electricity and magnetism.

Robert S. Orr, general manager of the Duquesne Light Company, Pittsburgh, Pa., died at Pittsburgh on Jan. 24. Mr. Orr was a native of Clarion County, Pa., and was a graduate of Washington and Jefferson University. For the first two years after his graduation he taught in the Washington and Jefferson Academy, after which he became principal of the Allegheny County (Pa.) public schools. In 1904 he left the teaching profession to accept the post of contracting agent for the Allegheny Light Company, the predecessor of the Duquesne Light Company, and a short time later he was made acting superintendent of the company. In less than a year Mr. Orr was given the post of general superintendent of the company, and it was in the course of his work in that position that he developed a system of concrete reinforcement of decayed poles which is now largely used in this country. For several years Mr. Orr served on the executive committee of the N. E. L. A. He was a past-president of the Pennsylvania Electric Association, and was a member of the Engineers' Society of Western Pennsylvania, the American Electrochemical Society and the A. I. E. E.

R. S. ORR

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

The New Features of 1917 Fan Designs

Improvements in fans this season are noteworthy on account of the fact that the changes made are not radical from the mechanical and electrical standpoint, but will have much to do with the saleability and attractiveness of the popular types of fans. Few new fans

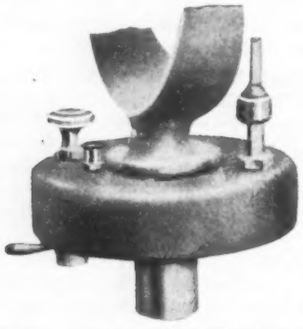


FIG. 1—OSCILLATING MECHANISM—MARELLI FAN

will be placed on the market this year. There seems to be a tendency by some manufacturers to use steel in places where brass was formerly employed, such as for guards. A notable feature is the ease of converting several of the new types from desk to bracket service. One company has developed fan blades and a guard attachment for sewing machine motors, another has designed a blade which it is claimed takes the hum out of fan motors. The majority of makers point out slight changes in designs to improve the appearance of desk and bracket types. Few changes have been made in ceiling fans.

H. Boker & Company, Inc., New York City.—A 10-in. fan with heavily nickel plated brass blades, guards and fittings is being offered to the trade by this company as distributers for Ercole Marelli & Company of Milan,

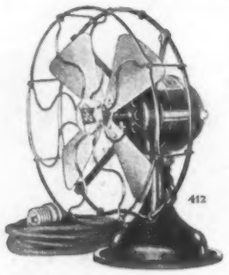


FIG. 2—ROBBINS & MYERS 8-IN. FAN

Italy. This fan has full swivel and trunnion movements, is instantly convertible from desk to bracket type, and has a two-speed switch with "off" position. This fan, it is claimed, is noiseless on 60-cycle alternating-current and remarkably quiet on direct-current circuits. Attention is also called to the oscillating mechanism shown in Fig. 1. By turning the thumb screw to the right the angle of oscillation is cut down degree by degree to a minimum of 10 deg. total oscillation. When the thumb screw is turned to the left the angle of oscillation is increased in a similar manner to a maximum of 120 deg. total oscillation. Both adjustments can be made while the fan is in operation. The oscillating mechanism may be locked in any position. In Fig. 4 is shown a self-rotating ceiling fan for use in large rooms. While the fan is running a slow rotary movement is obtained, the motor revolving around the vertical axis of the suspension rod.

Emerson Electric Manufacturing Company of St. Louis, Mo.—Emerson swivel-trunnion (non-oscillating) fans

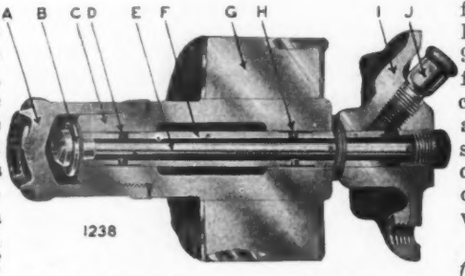


FIG. 3—CROSS SECTION OF EMERSON FAN

for 1917 are of the same design as sold last year. The 8-in. fans are no longer listed for alternating current or direct current, but the 9-in. fan offered last season is made in both oscillating and non-oscillating styles for alternating and direct-current circuits. Emerson 12 and 16-in. non-oscillating fans are equipped with carrying handles on top of the motors. The oscillating fans for 1917 are all new models with certain minor improvements which have been made without changing the electrical design or decreasing the flexibility and durability of the oscillating device. Details of the oscillating device are shown in Fig. 14. Emerson oscillators of 12 and 16-in. sizes in all types have carrying handles for convenience in lifting the motor. The adjusting collar of the oscillating device, which permits changing the position of the motor on the base to point the fan where the breeze is wanted, makes frequent lifting of the motor unnecessary. The popular six-blade, slow-speed, ultraquiet residence type in the 12-in. size is included in the 1917 line, and has been equipped with a new style base and handle. This year the line of oscillating fans for alternating current has been completed by the addition of a 16-in., six-blade, slow-speed oscillator, which is expected to be useful in theaters, assembly rooms, banks, churches and other places where it is necessary to use a quiet fan but where maximum obtainable breeze is highly desirable. Emerson direct-current oscillators, in 9, 12 and 16-in. sizes, carry the same improvements as the alternating-current fans referred to. In addition to the 9, 12 and 16-in. four-blade direct-current oscillators, a six-blade, slow-speed, 12-in. direct-current style is offered for private offices, hotel bedrooms and such places where an ultra-quiet fan is necessary.

FIG. 4—MARELLI FAN

Robbins & Myers Company, Springfield, Ohio.—One new model has been added to the Robbins & Myers line of 1917 fans. This is an 8-in. non-oscillating design, shown in Fig. 2, with a drawn steel frame. With the addition of this fan, the entire line of Robbins & Myers fans are now furnished in the drawn steel construction. The 8-in. fan, known as model 28, is the universal, series type. It is also made to operate on low-voltage storage battery circuits. A switch in the base provides two running speeds. Model 26, alternating current, and model 27, direct current, is a 9-in., five-blade oscillator. Model 26 has a universal series motor and will operate on 100 to 120 volts direct current as well as 100 to 120 volts alternating current, 25 to 60 cycles. It is also made for 220 volts alternating current service, and model 27 for 220 or 32 volts direct-current circuits. Models 21, alternating current, and 22, direct current, are non-oscillating fans which are made in 12-in. and 16-in. sizes for operation on all standard voltages and frequencies. They can be furnished with four or six blades as desired.

Model 24, alternating current, and

model 25, direct current, are oscillating fans made in 12 and 16-in. sizes, with four or six blades, for operating on all standard voltages and frequencies. All desk and oscillating fans are

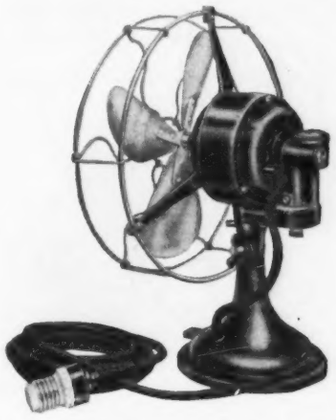


FIG. 5—CENTURY 9-IN. OSCILLATING CONVERTIBLE FAN

supplied with a separable plug and 10 ft. of new code, black reinforced cord. All are adjustable, for desk or wall bracket mounting. The standard finish is black with gold stripes around the body.

The company's line of ceiling fans is the same as offered in 1916. Style "H" is a plain type alternating-current fan, which when furnished in ornamental design is known as style "G." Style "B" is a plain type direct-current fan. A direct-current ornamental fan, known as style "C," is also supplied. A 12 and 16-in. ventilating fan will be furnished in the same design as in previous years.

Eck Dynamo & Motor Company, Belleville, N. J.—A new development is the —ming blade, shown in Fig. 7, to eliminate the objectionable humming which has existed in fan motors. The illustration does not plainly indicate how this is accomplished since the face view in the picture shows only the shape of the blade, and the fact that the four blades are not of exact peripheral diameter, but it does not show that the pairs of blades travel in different planes. It is claimed that it is the combined effect of the shape

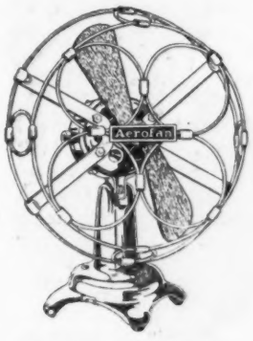


FIG. 6—RUSSELL ELECTRIC 8-IN. FAN

of the blade, differences in peripheral diameter and the fact that they travel in different planes, that eliminates the hum so often evident and objectionable in fan motors.

Western Electric Company, New York City.—This company has provided its 6-in. fan with a knuckle joint, allowing it to be used either as a bracket or desk fan, and making it possible to tilt the fan or incline it at various angles. Since this design is primarily a residence fan its attractiveness has been improved by finishing it in frost bronze instead of the conventional black and polished brass.

Several changes have been made in the construction of the Western Electric oscillating fan for 1917, these being, however, small improvements in details of construction. Probably the most significant improvement in the oscillating type is the method of adjusting the arc of oscillation by means of a knurled head screw on the back of the fan in the bottom position. This screw is easily reached and easy to turn, making it possible to adjust the arc of oscillation without stopping the fan. If a foreign object should retard the oscillating movement the fan will continue to operate as an ordinary desk fan. In the construction

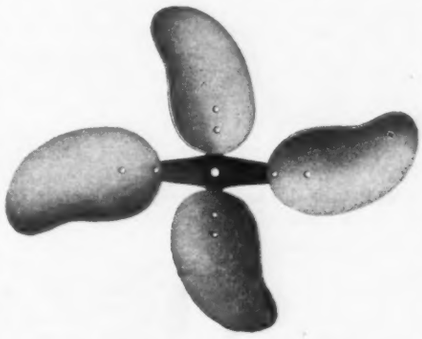


FIG. 7—BLADE OF ECK FAN

of both oscillating and desk fans wing thumb screws have been used for making the various adjustments. The guards of the 1917 Western Electric desk and oscillating fans, except for the 6-in. fan, are black Japan instead of brass. It is believed that this is a positive improvement, as brass guards become tarnished and are difficult to clean, whereas the black Japan finish will always look good and is easily cleaned. This year, instead of glued felt on the bottom of the desk and oscillating fan, six hollow rubber washers are used inserted in the base and permanently glued there. Three of these six rubber feet have holes which continue up through the base of the fan for fastening it down where such a method is desired.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—During the past year or two a distinct demand has developed for a low-priced electric fan for use in the home. The Westinghouse Electric & Manufacturing Company has included in its regular line of 1917 fans such a type, known as the "Westinghouse-Whirlwind," which is an 8-in. fan weighing about 6 lb. Black steel blades are used as well as a black steel guard instead of brass. The speed control switch is omitted so that the fan has only one speed. It has a hinge joint so that it can be mounted on a wall if desired, and the patented felt base with which all Westinghouse fans are provided.

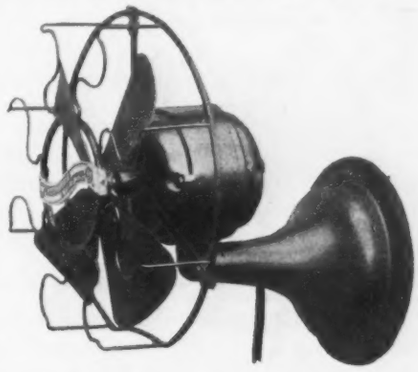


FIG. 8—WESTINGHOUSE 8-IN. FAN

Hamilton-Beach Manufacturing Company, Racine, Wis.—This company has developed a fan blade and guard attachment to fit its sewing machine motor. As shown in Fig. 11, this device is so constructed that it is easily attached and held by the pressure of two springs. The fan is nickel-plated to harmonize with artistic furnishings.

Russell Electric Company, Chicago, Ill.—The fan shown in Fig. 6 is known as the Aerofan, and supplied in the 8-in. non-oscillating size, with a perfectly formed 8-in. aeroplane propeller. An advance made by this company is the possible speed regulation of its universal motors by bringing out the field taps. This affords good speed regulation on both direct and alternating current, and is most economical of current since it gives full efficiency on all speeds.

Century Electric Company, St. Louis, Mo.—A feature of this company's 1917 9-in. oscillating desk and wall-bracket fan is a construction such that a change of direction of oscillation can be made without adjusting any part of the fan. This is done by simply turning the motor on the swivel stud. The oscillating mechanism consists of a steel worm with bronze gears readily accessible. The body and stand is of drawn steel, with the blades and guard

FIG. 9—WESTERN ELECTRIC 6-IN. FAN

of brass, dipped and lacquered. The 60-cycle fans make seven complete oscillations per minute. Existing designs of stationary, oscillating and ceiling fans have not been changed.

General Electric Company, Schenectady, N. Y.—Most of the 1917 types listed by this company are practically identical with those of last season, only such changes as engineering experience

FIG. 10—GILBERT FAN

has shown advisable having been made. The 9-in. fans were especially designed to meet the demands of those who consider the 8-in. fan too small for effective service. The control switch which is mounted in the base is of the improved lever design with notched guide, insuring a positive setting for each speed. The ease of conversion from desk to bracket type is a feature the maker points out for its 12 and 16-in. designs.

A. C. Gilbert Company, New Haven, Conn.—This company's new model "C" Polar Cub fan now has two speeds and a stop. The frame is rigidly die-cast, thus eliminating fifty-seven different parts, it is claimed. Its bearings are an integral part of the die castings. The fan is adjustable to any angle so that a breeze can be thrown in any direction. The base has a hook for attaching to wall if desired. The net weight of this fan is 3 lb. 5 oz. A strong spot-welded guard is provided.

Pittsburgh Electrical Specialties Company, Pittsburgh, Pa.—This company makes a line of 8-in., 6-in. and 4-in. fans. The 8-in. fan is a combination desk and bracket type, with a three-speed universal motor, and weighs 5.75 lb. The finish is full nickel or black Japan with brass blades. To supply the demand for a smaller and lighter fan than the 8-in., a 6-in. design is made that weighs only 3.75 lb. This fan has a single-speed universal motor, a round base and is finished in full nickel or black Japan with brass

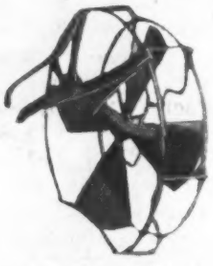


FIG. 11—HAMILTON-BEACH BLADES AND GUARD

blades. A still smaller fan is made by this company, designed especially for the use of travelers. It has blades 4 in. in diameter, weighs only 2.5 lb. and is finished in full nickel or black japan with brass blades. The motor is single-speed, of the universal type.

Manhattan Electrical Supply Company, New York City.—No radical changes in design and construction have been made in the 1917 fans offered by this company. In Fig. 13 is shown a direct-current desk fan in use as a wall fan. This fan is made in two sizes, 12-in. and 16-in. The 8-in. direct-current fan is supplied with a knuckle joint, which permits the body to be moved vertically, but is not adapted for use as a wall fan.

Peerless Electric Company, Warren, Ohio.—About the only changes made by this company in existing designs is the discontinuance of the 8-in. fan and the substitution of a 9-in. fan. This 9-in. fan will be built in two types: The cast frame commutator type, which will be a universal fan, and will operate on either alternating or direct current; and the drawn steel type, which will be built on the straight induction principle for use on alternating-current service. The commutator type will be furnished for direct-current circuits. Both the drawn steel and cast-iron fans will be built in oscillating and non-oscillating types. All the different sizes of this company's oscillating and non-oscillating fans this year will be equipped with black guards and brass blades.

The Carleton Company, Boston, Mass.—This company will continue to offer its moderate priced universal fans in 6-in. and 8-in. sizes, with slight

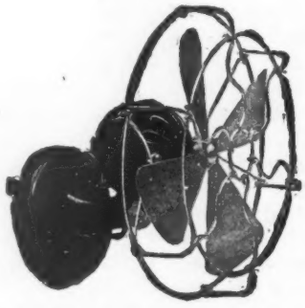


FIG. 12—CARLETON 8-IN. FAN

changes in adjustment and in winding. The motor case is a die casting, and the standard finish is black enamel with guard and blades in nickel on brass, this, it is claimed, being the most permanent bright finish yet known. The 6-in. fan is furnished in the oscillating desk and bracket type. All sizes and styles will be made for operation on any voltage from 4 to 120.

Adams-Bagnall Electric Company, Cleveland, Ohio.—This company calls particular attention to its 1917 alternating-current Gyrofan and oscillating fans. The main changes that have been incorporated in the Jandus and Adams-Bagnall designs cover improvements in detail which give higher operating efficiency and better mechanical service. Fundamentally the fans are not new. They have been in service in sufficient numbers to permit a careful study and analysis of reported troubles which have made it possible to eliminate weak points and strengthen the mechanical features which are so essential in fans of this type in the field. The oscillating fan of the Jandus type which is known to the trade has been improved by details in the course of

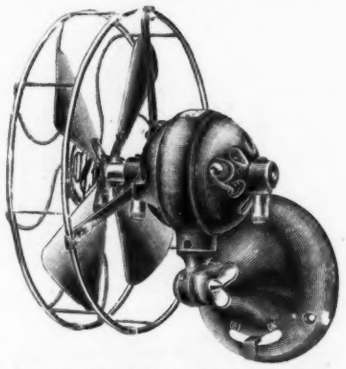


FIG. 13—MANHATTAN CONVERTIBLE FAN

years, as well as in the substitution of a roller or resilient pin which increases the number of points of contact and the resulting service. The Gyrofan line is available in column and ceiling types, with and without light attachment.

Designs of fans that have already proven satisfactory in service are being offered this season by a number of companies. The Crucet Manufacturing Company of New York City has made no changes in its existing fan designs, but announces that later it will bring out one or two extra types. The Knapp Electric & Novelty Company of New York City, makers of battery fans, has made no changes for the 1917 season. The Fidelity Electric Company of Lancaster, Pa., has developed no new fans. Attention is called to the fact that its type "B" ceiling fans have proven popular with the export trade. The Menominee Electric Manufacturing Company of Menominee, Mich., The Lindstrom-Smith Company of Chicago, and the Kokomo Oscillating Fan Company,

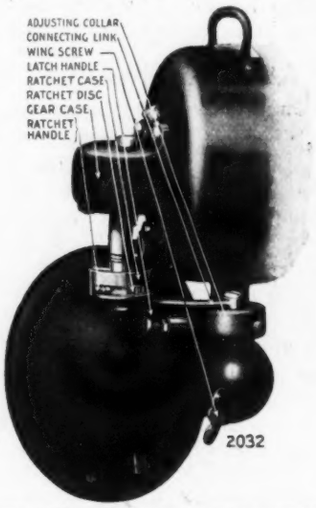


FIG. 14—EMERSON OSCILLATING MECHANISM

Kokomo, Ind., have made developments in fans which are not, however, available at this time but will be described in later issues of the ELECTRICAL WORLD.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Public Service Commission News

District of Columbia Commission

The Public Utilities Commission, on its own initiative, has made an investigation preliminary to prescribing standards to secure the accuracy of all watthour meters for the measurement of electrical energy in the District, as required by the Public Utilities Law. A set of regulations, following closely those promulgated by the United States Bureau of Standards, has been prepared and will take effect after Feb. 1.

New Jersey Commission

Statistics of Public Utilities of New Jersey for 1915, Part 1, have been published by the Board of Public Utility Commissioners. This volume contains the assets and liabilities accounts, names of principal officers, income account and important changes for the year of every class of public utility company of which the gross operating revenue for the year exceeded $10,000.

Idaho Commission

The Public Utilities Commission recently ordered the Rupert Electric Company to lower the flat rate it has been charging its patrons, reduce the flat charges made against its customers for power service, and refund to its patrons all money it has collected from them in the form of deposits on meters. The electric company has been charging a flat rate of $1.50 per month for its service. That rate was cut to $1.00 by the commission. A flat rate of 75 cents a month, based on horsepower, known as the "service charge," has been charged on motors. The commission ordered that rate cut to 25 cents a month. Heretofore, the company demanded a deposit of $10 before installing a meter. The commission ordered the custom discontinued and all money received on deposits returned to patrons at the rate of 75 cents a month. Where the service has been discontinued, the money is to be returned in full at once.

Illinois Commission

The State Public Utilities Commission has authorized the Saline Electric Company to purchase the municipal electric plant belonging to the City of Ashley, County of Washington. Although the original plant cost $13,000, the commission authorized its sale at $6,000. Hereafter the public of the city of Ashley will be served from the general transmission system of the Saline Electric Company. In its opinion the commission says:

"The said plant was installed some twelve or fifteen years ago and, to use counsel's words, * * * 'has been a "white elephant" on Ashley's hands ever since.' The city of Ashley, under date of Oct. 13, 1916, granted the Saline Electric Company a franchise which runs for twenty years from the date thereof, and the representative of the city of Ashley has stated that the public thereof desires to dispose of its municipal electric plant. It is the purpose of the Saline Electric Company to improve generally the electric service rendered in the city of Ashley, and, in time, to reduce electric rates somewhat. The said Saline Electric Company has signified its intention of abandoning the obsolete direct-current generating and switchboard equipment at an early date and of installing, in lieu thereof, a new electric transmission line to connect the electric distribution system in the city of Ashley with the general transmission system of the said company."

California Commission

In its decision permitting the absorption by the Pacific Gas & Electric Company of the Oro Electric Corporation, as reported in the ELECTRICAL WORLD for Jan. 20, the Railroad Commission says that it is clear from the evidence that a very substantial benefit and advantage will accrue to the Pacific Gas & Electric Company by this consolidation, but that the consent of the Railroad Commission, which is a *sine qua non*, should not be granted unless the public interest is advanced thereby.

It is not sufficient that the Pacific Gas & Electric Company is to derive a benefit from the bargain, says the Railroad Commission. "The fundamental test which overrides any benefit to any single party is whether or not the public interest will be served by the consolidation. The consolidation will result in the elimination of any possible competition between the Pacific and the Oro companies. If the public is to be deprived of the benefits of possible competition, it has the right to expect in lieu thereof substantial benefits resulting from the proposed consolidation.

"There is a further matter of considerable importance to which attention should be directed. Certificates of public convenience and necessity were heretofore granted by the Railroad Commission to the Oro Electric Corporation covering large areas in Sacramento Valley, which up to the present time have had little or no electric service. These certificates were granted on application by the Oro Electric Corporation that it intended to develop these sections of the State, and would be able to do so if certificates were granted as prayed for. The Railroad Commission granted these certificates in the hope and expectation that these portions of the State would be developed by the Oro Electric Corporation. These hopes have not been realized. The Pacific company is now failing to take over any except a few franchises owned by the Oro corporation, and is asking that certificates of public convenience and necessity heretofore granted by the Railroad Commission be revoked except to a certain small extent.

"The Pacific company should be very liberal in making extensions into the undeveloped territory which the Railroad Commission hoped that the Oro corporation would develop, and the Pacific company should look largely to the development of the future as well as to the immediate business of the present. Unless electric companies which, during good behavior, may enjoy a practical monopoly in the thickly populated districts in this State, are willing to make extensions liberally into outlying undeveloped sections of the State, there is very serious question as to whether the policy of regulated monopoly of such public utilities as may be referred to as natural monopolies, which policy is now the settled policy of the State, will be a blessing to our people in the long run."

Edison Birthday Party.—The seventieth birthday of Thomas A. Edison, which occurs on Feb. 11, will be celebrated during the evening of Feb. 10 at the Edison Storage Battery Works, East Orange, N. J. It is expected that some 1500 people will be present, including employees and some of Mr. Edison's old associates. The entertainment will consist largely of Edison moving pictures and selections on the Edison phonograph.

Electrical Aid in Ice Cutting.—Ice harvesting has been in progress for the past week or two at Sandusky, which is one of the largest natural ice centers in the lake region. Practically all of the machinery used in hoisting, storing and loading cars is now operated electrically, central-station power being used. One of the producing ice companies is now installing an additional 100 hp. for use next year.

New York City Energy Output.—The total energy output of the electric companies operating in New York City sold to the public during 1915, according to the report of the Public Service Commission for the First District of New York, was 727,004,884 kw.-hr., an increase of 7.73 per cent over the preceding year. The number of customers was 306,217 as against 265,254 in 1914. The total revenue from sales of energy to the public was 344,936,019, an increase of something more than $100,000 over the receipts of 1914. This is the first time since the commission was created that the annual revenue from the sale of electric current has exceeded that from the sale of gas.

Validity of Contracts with Municipal Plant Questioned.—The case of the City of Cleveland (Ohio) against the Tropical Paint & Oil Company to collect the penalty of $256 for terminating a five-year contract with the municipal light plant before its expiration was heard before Judge P. A. White of the Common Pleas Court at Cleveland last week. Attorneys for both the company and the city intimated that the case will be carried up in the event that the decision is against their clients. It is, therefore, probable that the Supreme Court will eventually say whether the 19,000 contracts with the plant are valid or not. In answering the suit, attorneys for the company declared that the city rates for energy are not valid because they were not fixed by ordinance, as required by the Ohio constitution. They argued further that the city board of control is without authority to fix rates, which they claimed must be established by legislative action, subject to the approval of the electors if a referendum is demanded. The contracts are invalid also, the attorneys contended, because they lack mutuality. Penalties are fixed for the termination of contracts before they are due by the users, but the city is exempted from liability for interruptions in furnishing energy. It was said that interruptions of the service caused the company to abandon the use of municipal station energy. Attorneys for both sides were asked to submit briefs, and a decision is expected within a week or ten days.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Brooklyn Edison Employees.—W. F. Wells, vice-president of the Brooklyn Edison company, addressed the annual meeting of the company, N. E. L. A. section, on the progress made in the company during the past twenty-five years, the time which Mr. Wells has been with the company. In 1892 the Brooklyn Edison company had but 100 employees, whereas now there are over 2500. Mr. Wells brought out the fact that the company has approximately $16,000 invested for every employee. He also mentioned the new issue of bonds about to be made by the company, urging the advisability of employees investing their savings in the securities of the company.

Milwaukee Citizens Demand Reappointment of Consulting Engineer.—In May, 1916, the council of Milwaukee, Wis., authorized the appointment of a consulting engineer to assist the department of public works in preparing plans and specifications for the city's $1,500,000 street lighting system. Money was appropriated to pay the engineer for a period of six months. That period expired on Jan. 1, 1917, and no official steps have yet been taken to reappoint the engineer, in spite of the fact that it was not possible to complete the work begun during the first six months. At the present time a non-partisan organization, composed of representatives from all local civic and professional clubs, and known as the Mayor's advisory board, is demanding that the city's former consulting engineer, F. A. Vaughn, be reemployed and be instructed to complete the work.

Counselor's Opinion Destroys St. Louis Conduit Space Monopoly.—A formal opinion by the assistant city counselor of St. Louis destroys the monopoly of conduit space in downtown streets by the Union Electric Light & Power Company and overrules opinions by former city counselors. The assistant city counselor's opinion agrees with a similar opinion by a former city counselor and is one of a series of conflicting opinions on the enforcement of the Keyes ordinance enacted many years ago. The board of public service in the opinion is advised it may permit other electric light companies to install conduits in streets which were not assigned under the Keyes ordinance and in streets and alleys which may have been assigned but are not used for conduits. This will open up about one-half of the streets of the city and is deemed a victory for the Cupples Station Light, Heat & Power Company, which for some time has been fighting for permission to install conduits to compete with the Union Electric.

Bill to Permit State to Operate Utility Plants.—State ownership and operation of public utilities is made possible under terms of a bill before the Kansas House. The bill provides that where service by public utility corporations is not satisfactory the property may be taken over and operated either by the State or by any city. The measure permits the State or a city to purchase a public utility outright or to secure possession through condemnation proceedings. All corporations doing business as public service corporations are affected by the measure.

Engineers Discuss Industrial Americanization.—At a dinner given on Jan. 19 by Mr. and Mrs. Vincent Astor in their New York home to 160 engineers and college professors the topic of "Industrial Americanization" was broadly discussed. Gano Dunn, president of the J. G. White Engineering Company, who presided, in announcing the purpose of the gathering said: "Industrial Americanization is a part of the present-day movement toward the humanization of industry. It aims to make what is commonly called 'welfare work,' not an exercise of the employers' 'paternalism,' but a legitimate part of business organization everywhere." A number of prominent engineers delivered addresses, among whom was M. I. Pupin.

Summary of Bills So Far Introduced at Albany Affecting Electrical Interests.—A number of bills affecting public utility operation have been introduced in the New York Assembly. Those affecting electric light and power corporations are as follows: Assembly No. 101. Amending subdivision 1, section 10, general corporation law, by permitting a railroad corporation, street railroad corporation or manufacturing corporation which generates electric power to use in its business to sell surplus current to the State or any city, town or village or any lighting district or private person or corporation, and to obtain a franchise for that purpose. Assembly No. 159. Adding new section 24-a to public service commissions law, requiring the commission to render decisions within one year from filing of complaint unless the time is extended by the court and providing that the commission's decision may be reviewed by certiorari and regulating the procedure. Assembly No. 235. Adding new section 269 to the highway law, providing for the acquisition by the State of toll bridges for vehicles and foot passengers which constitute a connecting link between two State highways, upon petition of the supervisors of the county or counties in which the bridge is situated. Bridges so acquired shall not be used by railroads, telephone, gas, electric light or other public service corporations except upon the payment of rental, to be determined by the State Highway Commission. All of these measures are still in committee, there having been as yet no regular calendar in either the Senate or Assembly. Public hearings will no doubt be held on the more important measures before any action is taken on them.

Officers of Electrical Contractors' Association of Wisconsin.—At the recent annual meeting of the association the following officers were elected: President, Paul Honold, Sheboygan; vice-president, A. M. Kailing, Milwaukee; treasurer, H. F. Trester, Milwaukee; secretary, J. C. Staff, Milwaukee; director, R. J. Nickles, Madison; director to National Association, Paul F. Harloff, Madison.

Tri-State Convention in April.—The Tri-State Water and Light Association of the Carolinas and Georgia will hold its seventh annual convention at Macon, Ga., on April 17, 18 and 19. E. M. Anderson of Abbeville, S. C., is president, and W. F. Stieglitz of Columbia, S. C., is secretary-treasurer. The association's committee on electrical affairs is W. Rawson Collier, Atlanta; R. T. Long, Anderson, S. C., and W. H. Gallant, Charlotte, N. C.

Mid-Winter Meeting of Portland Electrical Men.—At the annual mid-winter meeting of the Portland, Ore., sections American Institute of Electrical Engineers, and National Electric Light Association, held at the Multnomah Hotel recently, the dinner served was prepared by demonstrators from the electrical companies in Portland and pupils of the domestic science department of the public school. Electric cooking apparatus was used.

Meeting of Portland Engineers.—The American Institute of Electrical Engineers, National Electric Light Association, and Oregon Society of Engineers, Portland sections, held their sixth biweekly luncheon on Jan. 17 in the Oregon Hotel. The luncheon was conducted by the General Electric Company, E. F. Whitney, chairman. W. D. B. Dobson, secretary of the Portland Chamber of Commerce, gave an address on "Industrial Activities of the Northwest."

Officers of Western Society of Engineers.—Announcement of the election of the following officers of the Western Society of Engineers for 1917 was made at the annual banquet of the society on Jan. 10: President, Henry J. Burt, structural engineer for Holabird & Roach; first vice-president, Denney W. Roper, superintendent of the street department of the Commonwealth Edison Company; second vice-president, James N. Hatch, consulting engineer; third vice-president, Wilford W. DeBerard, *Engineering Record;* treasurer, Carlson R. Dart, consulting engineer.

Smelter Smoke and Fume Problem.—At a joint meeting of the New York sections of the American Institute of Mining Engineers and the American Electrochemical Society on Jan. 26 a symposium was held on the smelter smoke and fume problem. The following papers were presented: "The History and Legal Phases of the Smoke Problem," by Ligon Johnson, consulting attorney, International Nickel Company and American Smelting & Refining Company; "Theoretical Aspects of Electrical Precipitation," by W. W. Strong, Scientific Instrument & Electrical Machine Company; "The Cottrell Process in Practice," by Linn Bradley, Research Corporation.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Southwestern Convention in April.—The thirteenth annual convention of the Southwestern Electrical & Gas Association will be held April 26, 27 and 28, at Dallas, Tex.

Steel Conductors Discussed at Toronto.—"Steel Conductors for Transmission Lines" was the subject of a paper by H. B. Dwight, Canadian Westinghouse Company, before the Toronto section, A. I. E. E., on Jan. 19.

The Electrical Development & Jovian League of San Francisco.—At the regular luncheon held Jan. 17, J. J. Dwyer, president of the Board of State Harbor Commissioners, gave a talk on San Francisco's harbor improvements, enumerating the variety of uses to which electricity is put on the waterfront.

Springfield Engineers Elect Officers.—The Springfield (Ill.) Engineers Club installed the following officers for the ensuing year at the regular meeting Jan. 15: President, B. H. Peck, electrical engineer, State Public Utilities Commission; first vice-president, B. G. Campbell, assistant manager, Springfield Gas & Electric Company; second vice-president, F. R. Atwood, chief engineer, Central Union Telephone Company; recording secretary, J. R. Hughes, assistant engineer, State Public Utilities Commission; corresponding secretary, Curtis Prout, electrical engineer, Illinois Traction System; treasurer, C. A. Crytser, power plant engineer, Springfield Gas & Electric Company; sergeant at arms, A. N. Detweiler, superintendent, National Zinc Works.

Joint Dinner of Engineers at Boston.—Prof. Elihu Thomson, consulting engineer, General Electric Company; Dr. Hugh Cabot of Boston, Mass., and E. H. Ewertz, superintendent of the Fore River Shipbuilding Corporation, Quincy, Mass., will be the principal speakers at the eighth annual informal banquet of engineers of Boston and vicinity, which will be held at the Boston City Club on the evening of Feb. 7. Professor Thomson's subject has not been announced, but Dr. Cabot will speak upon recent experiences at the battlefront in France and Mr. Ewertz will give an illustrated talk on submarines. President Hale of the Boston Society of Civil Engineers, President Hollis of the American Society of Mechanical Engineers, and President Buck of the American Institute of Electrical Engineers will speak informally, and the toastmaster will be Prof. C. A. Adams of Harvard University. Ira M. Cushing, 84 State Street, Boston, is chairman of the dinner committee, and all engineers in Boston and vicinity are invited to attend, whether or not members of the above societies.

Dry Battery Manufacture.—The Jan. 23 meeting of the Dallas Electric Club and Jovian League was turned over to an educational address on the manufacture of dry batteries.

Electric Propulsion of Ships.—W. L. R. Emmett addressed the General Electric Alumni Association of the Apprentice Training System Jan. 26 at Schenectady on the topic "Ship Propulsion—Electrically Driven."

Relation of Central Station Activities to the Public.—Peter Junkersfeld addressed the Jan. 11 meeting of the Fort Wayne section, A. I. E. E., on the subject "Central Station Activities and Their Relation to the Public." The February meeting will be addressed by Harry Bower of the Overland company on "Sleeve Valve Motor."

Organization of Doherty Managers.—Fifteen managers and assistant managers of Doherty companies in Kansas, Missouri, Nebraska and Oklahoma, representing nine subsidiaries of the Doherty corporation, attended a meeting in Kansas City recently, at which plans were made for a permanent organization to meet semi-annually.

Western New England Electric Inspectors Elect Officers.—At the winter meeting of the Western New England section of the National Association of Electrical Inspectors held at Northampton, Mass., Jan. 10, the following officers were elected: President, L. N. Heebner, South Manchester, Conn.; vice-president, H. M. Mahoney, Turners Falls, Mass.; secretary and treasurer, R. J. Forsyth, Greenfield, Mass.

Anti-Glare Legislation.—E. J. Edwards, Nela Park, Cleveland, Ohio, on Jan. 26 addressed the Pittsburgh Section of the Illuminating Engineering Society on "Automobile Headlights and Anti-Glare Legislation." There was scheduled a demonstration of recent headlight apparatus and special open discussion by Director Hubbard and T. H. B. Patterson of the department of public safety, city of Pittsburgh; Capt. B. R. Marshall, department of traffic regulation, city of Pittsburgh; Dr. P. G. Nutting, chairman I. E. S. committee on glare; C. Elmer Bown, transportation and lighting expert, city of Pittsburgh, and Secretary Wolf of the Automobile Club of Pittsburgh.

Missouri Contractors' Annual Meeting.—The following program was arranged for the sixteenth annual meeting of the Electrical Contractors' Association of the State of Missouri, held Jan. 20: "Is a Retail Department Profitable to the Electrical Contractor?" by Charles A. Pierson; "What Should Be the Relations of the Jovians and the Electrical Contractor?" by C. A. Spaulding; "Why Should Not the State and Local Associations Be Chartered by the National Association?" by A. P. Denton; address on "Workmen's Compensation and Mutual Insurance," by Pierre R. Porter; "Union Labor versus Open Shop," by W. L. Hutchison; "What Should Be the Relations of the Jobber and the Electrical Contractor?" by L. E. Reid; "Should We Have a State Law Governing Electrical Construction?" by William A. Koenemann.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

INCREASED MANUFACTURING COSTS OF WASHING MACHINES

Prices Have Been Raised Since Beginning of Year Owing to Higher Production Costs, Which Have Advanced from 17 Per Cent on Some Items to 80 Per Cent on Others

Along with practically all of the other electric appliances, washing machines, as was reported in the ELECTRICAL WORLD for Jan. 13, on page 105, have been raised in price since the beginning of the year. The increases have been made necessary because of the increased cost of manufacturing materials and labor. As evidence of the extent to which production costs have advanced the following table is presented showing the percentages of increase in the quotations on manufacturing materials that enter into the fabrication of electric washing machines.

Woodstock	24 per cent
Castings	60 per cent
Galvanized iron	22 per cent
Copper	75 per cent
Motors	20 per cent
Switches	17 per cent
New code wire	64 per cent
Cold rolled, flats, hex, and square steel	43 per cent
Gears	20 per cent
Wringers	22 per cent
Miscellaneous	80 per cent

EXPORTS OF ELECTRICAL GOODS STILL INCREASING

November Figures Reach New High Record of $4,421,535, Bringing Eleven Months' Total to $35,494,803—$40,000,000 Mark Probably Reached in 1916

Again all past records have been shattered for the value of exports of electrical merchandise manufactured in the United States. In November last, the latest month for which figures are available, electrical goods to the value of $4,421,535 were exported from this country, as compared to the $2,744,847 in November, 1915. The previous high mark was during the preceding month, October, when the value of electrical exports was $4,045,645.

Particularly noticeable in the November trade were the exports of batteries, insulated wire and cable, telegraph instruments, and miscellaneous supplies. Battery exports were valued at $308,005 in comparison with $184,903 in the corresponding month of 1915 and the previous high record in 1916 of $173,734. Exports of insulated wire and cable were valued at $725,503, as compared with $302,089 in November, 1915, and the previous high record in 1916 of $575,024. Telegraph instruments were exported to the value of $54,562, in comparison with $12,154 in November, 1915, and the previous high record of 1916 of $25,488. In miscellaneous merchandise, the November, 1916, exports were $2,188,826, against $1,357,825 during November, 1915, and the previous high record of 1916 of $1,996,722.

The total for the first eleven months of 1916 was $35,494,803, in comparison with $22,164,250 in the corresponding period of 1915, and $18,342,552 in the corresponding period of 1914. With the exception of generators, fans, interior wiring supplies, arc lamps and carbon-filament lamps, every item enjoyed an export trade of greater value in the first eleven months of 1916 than in the first eleven months of the previous year.

Based on these figures, it is now estimated that the electrical exports for 1916 probably reached the $40,000,000 mark.

While this figure is considerably larger than that for any previous year, it must not be forgotten that comparisons are made of value only. Since the first of 1916 prices advanced considerably, and therefore a certain value in 1916 would represent a smaller quantity of goods than the same value in 1915. In some lines, such as metal-filament lamps, there has been an increase commensurate with the increase in values. In other lines, however, such as insulated wire and cable, it is doubtful if there has been any great increase in quantity, although the values show an increase as large as 67 per cent. Furthermore even in the lines in which decreases were shown a comparison of volume of goods would probably show a greater decrease.

The accompanying figures were compiled by the Bureau of Foreign and Domestic Commerce.

	November		Eleven Months Ended November	
	1915 Value	1916 Value	1915 Value	1916 Value
Batteries	$184,903	$308,005	$1,254,835	$1,812,793
Dynamos or generators	58,850	182,653	1,755,808	1,561,806
Fans	55,849	21,169	354,341	290,349
Insulated wire and cable	302,089	725,503	2,586,723	4,312,845
Interior wiring supplies, etc., including fixtures	79,580	55,069	805,924	790,907
Arc lamps	2,115	731	20,591	14,321
Carbon filament lamps	13,186	14,492	134,870	113,262
Metal filament lamps	98,703	121,623	744,190	1,287,132
Meters and other measuring instruments	85,113	76,272	588,666	781,409
Motors	293,540	410,211	3,045,163	4,403,444
Telegraph instruments (including wireless apparatus)	12,154	54,562	122,689	193,689
Telephones	30,308	189,923	822,901	1,512,862
Transformers	170,632	72,496	687,203	964,798
All other	1,357,825	2,188,826	9,240,346	17,455,186
Total	$2,744,847	$4,421,535	$22,164,250	$35,494,803

CHINA A MARKET FOR AMERICAN ELECTRICAL GOODS

Banking Connections Essential—Practically All Business Done on a Friendship Basis—Alliance with Established Trading Companies Thought Advisable

Julean Arnold, American commercial attaché of the Bureau of Commerce of the United States at Peking, speaking to a representative of the ELECTRICAL WORLD recently, said, "In spite of the fact that China has now only about twenty electric lighting companies, none of which are hydro-electric plants, there is a real market for electrical goods in that country. This business cannot be secured," he continued, "by remaining in America and sending catalogs to the Chinese. Neither does it pay to write letters to them or to solicit in any way other than by sending salesmen directly to their cities. Practically all business in China is done on a friendship basis, and American commercial concerns in order to secure the business must have American representatives among the Chinese people to work up friendships upon which sales can be made.

"Broadly speaking, there are two practical ways of going after Chinese trade. One of these would be for engineering, banking and manufacturing concerns to form a company for financing, building and operating electrical, mining, and other industrial plants in that country. The market for electricity exists in China; there is only needed the services of an entrepreneur.

"The other plan would be for individual electrical manufacturers to form alliances with companies which are now

in the business of exporting and importing goods at Chinese ports. There are a number of such concerns now well established in the business but are without agencies in electrical goods."

A list of these firms can be obtained from Mr. Arnold.

It should be possible, said Mr. Arnold, for electrical concerns to make arrangements with these companies similar to that which the larger electrical manufacturers of the United States have made with other exporting and importing concerns. It should be a part of such an agreement, however, that the electrical company would be represented in the Chinese office by an American sales engineer. A Chinese salesman of American electrical goods has no success among his own people, even though he may have an American education, because his own people will not believe his statements about the goods as quickly as they will believe the statements of an American. Mr. Arnold said further that the chances of interesting Chinese capitalists in building electric lighting plants for their own cities is splendid, particularly if the American who is handling the proposition in China can speak the language of that country.

CONDITIONS OF JOBBING TRADE IN NEW ENGLAND

Difficulties Continue to Be Felt in Securing Deliveries and Adequate Supply of Both Labor and Raw Materials

Practically no sign of abatement in the rush of business is evident at the moment in the New England jobbing field, although well-informed circles are convinced that a recession is bound to come if prices continue to increase. Difficulties continue to be felt in securing deliveries and there is a shortage of both labor and raw material. The competition of munition-making plants continues to be felt, especially in the lower-priced grades of labor, notably office boys, stocks and order clerks. Transportation and manufacturing delays are still militating against the jobber's reaping the full benefits of the present great demand for appliances and material, which continues even in the salaried class which have profited little by "prosperity," the cost of these delays being estimated at at least $1,000 a week in one prominent house, with reference to its 1916 business. Trained salesmen are in much demand, not only in connection with present trade requirements, but in preparation for future curtailment.

The fundamental influence of the war in Europe with respect to price advances is generally appreciated. Jobbers feel that the small contractor should give them credit for doing their best to fulfill requirements in the face of unprecedented obstacles. Buying is closer in New England than in the Middle and Far West, but it is still impossible to predict the date at which a slackening of demand will occur. The opinion is gaining ground that the opportunity is ahead for unifying the New England electrical trade more closely than has been accomplished in the past, although definite constructive steps are yet to be taken.

COPPER QUOTATIONS

Prices Continue to Advance Owing to Technical Condition of Market

Copper quotations continue to advance and, contrary to general opinion, have gone well over 30 cents. After the drop from the high levels late in 1916, when electrolytic reached 36 cents for immediate delivery, a slight reversal was expected. At that time it was evident that many consumers had over bought as a protection, for as the market quotations began to decline numerous small lots of resale copper were offered. It therefore seemed to be apparent that although the big producers were sold out for the first half of 1916 the market had been supplied and until the third quarter set in or Europe developed a new demand for copper it was expected the market would be sluggish, with prices hovering generally between 26 cents and 30 cents.

However, from the results of the last two weeks it is evident that the copper market is stronger technically than was believed. On Tuesday, January copper was quoted at 32.5 cents and February copper at 31.5 cents. Quotations for the separate quarters were as follows: First quarter, 31 cents; second quarter, 29.5 cents; third quarter, 27.75 cents, and fourth quarter, 26.75 cents.

These quotations are purely the results of the technical condition of the market. There has been no evidence of any large demand for copper, and what buying has taken place has been very small.

Customers are not only not buying for present requirements but there is no interest being shown in future deliveries. The uncertainties surrounding the possibilities of peace are deterring buyers from stocking heavily for future delivery at present prices. Caution is everywhere being exercised and for that reason it is not improbable that the present advancing market is but an attempt to force buyers to enter the market for second half copper.

VALUE OF SALES CONVENTIONS

Both Executives and Salesmen Benefit from the Accumulated Local Experience

This is the month of sales conventions. It is not a new idea but has been in practice for some years. Among the electrical distributers this activity has taken a firm root and each year January sees a number of other jobbers and manufacturers added to the list. Where a distributer has sales forces covering the entire country, each district may have its convention. Where the distributer has a local trade the convention is held at the home office. A number of distributers of electrical goods have conventions semi-annually, and some quarterly.

There is absolutely no doubt about the value of these meetings. Whatever the expense might be in getting the men together, it is repaid many times. At these conventions the men not only have an opportunity to discuss their local problems of distribution with others doing work of a similar character but the sales executives have an opportunity to become more intimately acquainted with (1) the problems involved in distributing the company's products; (2) the sales character of the individual distributers; (3) the individual centers of distribution; (4) what the men feel should be a change in design and other details of an almost equal value.

Besides what the company learns from its men in such a meeting it benefits in many other ways. Above all, such meetings breed a spirit of loyalty, a belief that the policies and the goods of the company are right. They sell the salesman his house and so long as the salesman is in this frame of mind half of the sales battle is won. The men meet other men who are working different territories and the exchange of views regarding selling methods, credit and collection methods, saleability of certain products, question of price, standard packages, competition, etc., makes the sales force far more efficient. The men go back to their territory fortified with the experience of dozens of others. Mistakes are therefore less liable to happen. The answers are ready for new problems before they arrive. Such benefits cannot be measured by the company in dollars and cents, but the annual statement bears evidence of it.

Furthermore, these meetings afford the executives an opportunity to pick with more intelligence men for better positions with the company's sales organization. It is here that the salesman shows whether he has just been selling goods or whether he has been studying the market carefully.

One of the tangible benefits of such gatherings is the receipt of the opinion of the staff regarding some new product the company proposes to market. Not infrequently as the result of these conferences does the company decide not to market the appliance. More frequently is some modification made in the model before it is announced to the trade. By such helpful suggestions the industry is annually saved large sums of money.

This year particularly will these conventions be of inestimable value in the matter of prospective business. The views of the local distributers will help the manufacturers and jobbers more accurately to gage their 1917 requirements. In view of the many uncertainties that clothe the new year such information is of the greatest importance.

Manufacturing and Industrial

M. B. Austin & Company, Chicago, Ill., have issued a new price list on wires and wiring supplies.

Diehl Manufacturing Company announces the change of address of its Chicago storeroom and repair department to 313 South Clinton Street.

Landers, Frary & Clark, New Britain, Conn., have issued a new price list on "Universal" appliances, a number of items showing changes effective Feb. 1.

Stoneware Electric Stove Company, Dover, N. J., has opened an office in Denver, at the Century Building, and one in San Francisco, at 279 Minna Street.

The H. T. Paiste Company, Philadelphia, Pa., manufacturers of electrical specialties, will build a one-story addition to its factory situated at Thirty-third and Cherry Streets.

The Metropolitan Electrical Products Company, Inc., 101 West Forty-second Street, New York City, announces that it has secured the representation of the Adjustable Fixture Company of Milwaukee.

The Electric Storage Battery Company, Philadelphia, Pa., has under construction new buildings which, when completed, will give it more than 20 acres of floor space, an increase of more than 60 per cent.

Kandem Electric Company, Inc., distributors for the Menominee Electric Manufacturing Company, has moved its New York office from 29 East Twenty-first Street to 58-60 Reade Street, in order to be in a position to make prompt deliveries and carry a larger stock.

W. L. Batt has been made sales manager of the Hess-Bright Manufacturing Company, and will have entire charge of its sales after Feb. 1. Mr. Batt has been connected with the Hess-Bright organization since its early days, and has for many years engaged in doing much of the pioneer work that was necessary to develop the industry in this country.

Chicago Pneumatic Tool Convention.—The annual convention of the sales and factory organizations of the Chicago Pneumatic Tool Company was held at the Great Northern Hotel on Jan. 11, 12 and 13. The program included a trip to the company's plant at Chicago Heights and a banquet at the Great Northern on Saturday evening. Dec. 31 closed the biggest month and the biggest year in the history of the company.

The Electric Crane & Manufacturing Company of Milwaukee, Wis., has been organized by a group of former officials and engineers of the Pawling & Harnischfeger Company, including S. H. Squier, M. A. Beck, Arthur Mayer, Leo Mayer and Arthur A. Fritsch. The company has purchased the plant of the former Fred M. Prescott Steam Pump Company, at Sixty-fourth and National Avenues, West Allis. The initial capital stock is placed at $300,000, with an ultimate capitalization of $1,000,000.

NEW YORK METAL MARKET PRICES

	Jan. 16 Selling Prices Bid	Asked	Jan. 23 Selling Prices Bid	Asked
	£ s d		£ s d	
London, standard spot copper..	130 0 0		130 0 0	
Prime Lake	28.50	to 29.50†	31.00	to 31.50†
Electrolytic	29.25	to 29.75†	32.00	to 33.00†
Casting	27.50	to 28.00†	28.50	to 29.00†
Copper wire base	38.00†		38.00†	
Lead	7.50		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.92½	to 10.00†	9.92½	to 10.00†
Tin straits	44.50†		45.50†	
Aluminum, 98 to 99 per cent..	51.00	to 55.00†	50.00	to 54.00†

OLD METALS

Heavy copper and wire	22.50	to 23.00†	23.00 to 24.00†
Brass, heavy	13.50	to 14.50†	13.50 to 14.00†
Brass, light	10.50	to 11.00†	11.00 to 11.50†
Lead heavy	6.37½	to 6.50†	6.85 to 7.00†
Zinc, scrap	6.50	to 6.75†	7.00 to 7.25†

COPPER EXPORTS

Total tons to Jan. 23 18,829

†Nominal.

Corporate and Financial

Ashland (Wis.) Light, Power & Street Railway Company.—A block of first mortgage 5 per cent bonds, due Jan. 1, 1939, is being offered at 95 and interest, yielding about 5.4 per cent.

Blackstone Valley Gas & Electric Company, Pawtucket, R. I.—The company proposes a change in the par value of its common stock from $100 to $50, a special notice having been sent out to stockholders for a meeting to be held on Jan. 29 to ratify the suggested change. The preferred stock will remain at a par value of $100 per share. In an explanatory letter to the stockholders, sent out at the same time as the notice of the meeting, William T. Crawford, secretary of the company, says that the proposed change is desirable in order that the common stock of the company may have an equivalent par value to the common stock of other large public utilities companies operating in this State, investors being accustomed to that basis in such stocks. A special act of the Legislature must be secured to allow the change to be made, and the officers of the company cannot ask for this action until the stockholders have approved the matter. If the change is made, the holders of common stock will turn in their certificates at the office of the company, and will receive for each $100 share two shares of the new stock. Each of the new common shares will carry the right to one vote, while each of the preferred shares, with par at $100, will have the right to two votes.

General Gas & Electric Company, New York, N. Y.—The combined revenues of the subsidiary companies in 1916 were derived from the following sources: Electric sales, 65 per cent; gas sales, 20.2 per cent; railway traffic, 12.5 per cent; steam heating, 2.3 per cent.

Kansas City (Mo.) Light & Power Company.—The Public Service Commission of Missouri has authorized the Kansas City Light & Power Company to increase its capital stock from $2,000, the figure at incorporation a year ago, to $4,977,300. This is the amount of bonds authorized to be issued, the bonds having already been placed. It is figured from this action of the commission that probably the valuation of the company will be placed at $7,465,950, which will be 50 per cent more than the authorized issuance of capital stock, and it is recalled that the company had asked a valuation of $7,500,000. If this valuation is placed, it is said to be likely that the rate suggested by the company, which will involve a reduction of about 20 per cent in present rates, will be allowed. The final report on rates probably will come shortly after March 1, when the company will announce its plans for erecting a central station.

Minnesota Utilities Company.—A merger of the Home Electric & Heating Company, Eveleth, Minn., Chisholm (Minn.) Electric Company and the Western Mesaba Electric Company of Coleraine, Minn., has been effected by the Minnesota Utilities Company, a Minnesota corporation, with an authorized capitalization of $1,000,000.

Northern States Power Company, Chicago, Ill.—By action of the board of governors of the New York Stock Exchange the issue of $18,000,000 first and refunding twenty-five-year, Series A, 5 per cent bonds of Northern States Power Company, dated April 1, 1916, has been listed on the Exchange.

Ohio River Power Company.—The American Gas & Electric Company, through its subsidiary, the Ohio River Power Company, will begin on Feb. 1 operation in Steubenville, East Liverpool, Toronto, Wellsville, Empire, Ohio, and Chester, W. Vo. Leases with ultimate purchase agreements have been taken on the electric light and power properties of the East Liverpool Traction & Light Company and the Steubenville & East Liverpool Railway & Light Company, which now supply the above communities. All of these towns are on the Ohio side of the Ohio River except Chester, and are situated north of the Wheeling district. The properties will continue to be operated in two districts. The Steubenville district, consisting of Steubenville, Toronto and Empire, will be under the management of A. C. Martin, formerly commercial manager of the Rockford (Ill.) Electric Company, and the East Liverpool district, embracing the remaining towns, will be under the management of C. E. Torrey,

formerly assistant manager of the Central Power Company of Canton, Ohio. The two districts have a combined population of 80,000.

Pacific Gas & Electric Company, San Francisco, Cal.—During the first half of January, 1917, sales of first preferred 6 per cent stock of the company to consumers surpassed previous records. In this time the company made 255 sales of this stock, aggregating $545,200, which leaves only 7453 shares on hand. Total sales since the first offering was made in June, 1914, have aggregated $14,254,700. A great deal of this stock, which was originally placed in the East, has been repurchased by California investors, and the management believes that eventually the bulk of the issue will be held in California.

Pennsylvania Utilities Company, Easton, Pa.—The energy requirements of the company in 1916 were 47,650,000 kw.-hr., as compared with 42,570,000 kw.-hr. in 1915, an increase of 12 per cent. The energy came from three sources—steam generation yielding 77.7 per cent of the total requirement, water 20.6 per cent, and purchased power 1.7 per cent. The output from steam was 17½ per cent more than in 1915, while water generation fell off 3½ per cent and purchased power takings were 10 per cent less. There are five generating stations. The Dock Street plant is the largest, and generated 27,755,000 kw.-hr. from steam in 1916. This was 58 per cent of the total energy requirements, and equivalent to an increase of 14 per cent in output over the previous year. The South Side station produced 14,134,090 kw.-hr., or 29.5 per cent of the system requirements, from steam and water. The total South Side output was 20 per cent more than the previous year, but the amount obtained from water (39 per cent) was 7.5 per cent less than a year ago, and steam production (61 per cent) was 44 per cent more than the previous year. The Bangor station (steam), yielding 1.3 per cent of the total, fell off 46 per cent in output from that of 1915. Columbia (water power) produced 1.7 of the total, but fell off 29 per cent from last year; and Stroudsburg (also water), producing 7.5 per cent of the total, increased its output over 1915 by 15 per cent.

Sierra and San Francisco (Cal.) Power Company.—In accordance with the authority received from the California Railroad Commission last October to issue $1,000,000 first mortgage 5 per cent, forty-year gold bonds, the company has filed with the commission an application to reimburse its treasury $52,014.92 from the sale of these securities. The previous authority of the commission conditioned that the bonds should be sold so as to net the company not less than 85, and that their proceeds were to reimburse the company for expenditures, as directed by the commission from time to time. The bonds were sold at the figure fixed by the commission, and the money is in bank to the credit of the company as a special fund. In September, October and November last, the company says, it spent the above mentioned sum, $52,014.92, for improvements. These capital expenditures were distributed over a great deal of the company's territory. On Jan. 10 of this year the company had on deposit $850,000 of this fund, and the authorization now asked will be the first payment of the bonds' proceeds.

Standard Gas & Electric Company, Chicago, Ill.—A block of $200,000 of 6 per cent gold notes, due Oct. 1, 1935, is being offered at 96 and interest.

Texas Power & Light Company, Dallas, Tex.—All regular employees of the company, and members of the employees' families or households now have an opportunity to purchase the preferred stock of the company on a partial-payment plan. This stock pays dividends at the rate of 7 per cent annually, the dividend being paid to stockholders quarterly. The stock will be sold at the par value of $100 per share, on terms of $5 down and $5 per month per share purchased. No individual can subscribe for more than ten shares. Employees subscribing will receive dividends on the full face value of the stock from the date the first payment is made, and no interest will be charged on the deferred payments.

Topeka Kansas Railway & Light Company.—The initial issue of $1,284,000 of first lien and refunding sinking fund 5 per cent gold bonds dated Aug. 1, 1916, and due Feb. 1, 1933, is being placed at 94 and interest.

United Water, Gas & Electric Company, Hutchinson, Kan.—An issue of $972,000 of 5 per cent first and refunding mortgage gold bonds dated Sept. 1, 1916, and due Sept. 1, 1941, is being offered at 96 and interest to yield about 5.3 per cent. Of this issue there is at present outstanding $991,000. A block of $350,000 of 6 per cent cumulative preferred stock is now on the market completing the financing of the property.

Wabash Valley Electric Company, Sullivan, Ind.—The Indiana Public Service Commission has authorized the purchase of the Sullivan County Electric Company of Sullivan, Ind., and the Clinton (Ind.) Electric Light and Power Company by the Wabash Valley Electric Company. Stockholders of the Sullivan County company will receive stock in the Wabash company to the amount of $117,000 par value and bonds to the amount of $161,200. Stockholders in the Clinton company will receive stock in the Wabash company to the amount of $124,000 par value and bonds to the amount of $38,800. The commission has authorized the Wabash company to sell $9,000 par value of stock to pay costs of organization and consolidation and $50,000 bonds at not less than 80 for extension and betterment of service.

York Pennsylvania Railways Company.—The annual report of the company and subsidiaries for the year ended Nov. 30, 1916, has just been submitted to the stockholders. Among the subsidiaries is the Edison Light & Power Company of York. During the year there was expended in betterments and extensions $136,500, of which $101,575 was put out for the light and power property. The earnings statement for the combined properties follows:

	1916	1915
Gross earnings	$967,496	$828,300
Operating expenses	$445,947	$411,346
Allowances for depreciation	40,541	20,658
Taxes	50,760	46,110
	$537 248	$478,114
Net earnings	$430,248	$350,186
Interest and bond discount	259,075	239,474
Net income	$171,173	$110,712

Surplus Account

Balance, Dec. 1, 1915	$136,532
Salvage	519
York Steam Heating Company	100
Net income for the year	171,173
	$308,324
Dividends paid	100,000
Balance, Nov. 30, 1916	$208,324

New Utility and Industrial Companies

The Elkader Light & Power Company of Elkader, Iowa, has been incorporated with a capital stock of $300,000 by F. H. Schmidt, C. G. Schmidt and R. F. Schmidt.

The Standard Electric Power & Chemical Company of Vancouver, Wash., has been chartered with a capital stock of $4,000,000 by D. F. Smith, C. D. Charles and John A. Jeffrey.

The Electric Properties Company of Cedar Rapids, Iowa, has been chartered with a capital stock of $60,000. The officers are John M. Redmond, president, and M. N. Thompson, secretary.

The Woodville (Okla.) Electric Light & Power Company has been incorporated with a capital stock of $1,500 by R. L. Buck, J. W. Bacon, M. U. Ayres, Guy D. Jackson and J. H. Vann of Woodville, Okla.

The Sparling Electric Company of Buffalo, N. Y., has been incorporated by J. A. Schreiber, J. M. Riexinger and F. T. Sparling of Buffalo, N. Y. The company is capitalized at $10,000 and proposes to do a general electrical contracting business.

The Best Electric Wire Company of Jamesville, N. Y., has been incorporated by E. C. Spencer, G. A. Cowles and A. A. Reed, 136 Cortland Avenue, Syracuse, N. Y. The company is capitalized at $250,000 to manufacture wire, wire rope, cable, conduits, etc.

The Justice Export & Sales Company has been incorporated with a capital stock of $5,000 to act as agent for electrical appliances, devices, lighting fixtures, etc. The

incorporators are: C. G. and W. J. Justice and E. C. Wilson, 94 Clendenny Avenue, Jersey City, N. J.

Worthley & Holland of Marlboro, N. J., have filed articles of incorporation with a capital stock of $40,000 to manufacture and deal in mill supplies and electrical apparatus. The incorporators are: Abbott Worthley, Alfred J. Holland and Robert C. Schanck, Jr., of Marlboro, N. J.

The Great Eastern Light & Power Company of Nashville, Tenn., has been chartered with a capital stock of $5,000 for the purpose of developing water power and other natural resources. The incorporators are: W. A. Batten, B. B. Askew, C. C. Collins, J. B. Seidstad and R. J. Van Horn.

The World's Cheapest Power Company of America has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000 and proposes to operate water-power plants. The incorporators are: Harry Ebert, August Muer and Henry Muer of Frederick, Md.

F. S. Cassaway, Inc., of Newark, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing and dealing in storage batteries and automobile accessories. The incorporators are: William A. Smith, Thomas S. Woodruff and Florence L. Ennis of Newark.

The International Power & Construction Company of Libby, Mont., has been incorporated by C. Edward Lukens, Leo H. Faust, M. Lukens and M. H. Faust. The company is capitalized at $250,000 and proposes to engage in manufacturing and mining and milling business and to own and develop public utility properties.

The Wright-Hibbard Industrial Electric Truck Motor Company of Buffalo, N. Y., has been chartered, with a capital stock of $300,000, to manufacture and deal in autos, industrial motors, water motors, steam turbines, locomotives, etc. The incorporators are: R. F. Hibbard, G. A. and W. H. Wright, 48 South Division Street, Buffalo, N. Y.

The Northwest Power Company of Augusta, Me., has filed articles of incorporation under the laws of the State of Maine. The company is capitalized at $500,000 and proposes to control, equip, deal in and operate all public work conveniences. The officers are: L. J. Coleman, president; M. F. Hearin, treasurer, and C. L. Andrews, clerk, all of Augusta.

The Central Utilities & Securities Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The company is considering increasing its capital stock to $500,000, and contemplates taking over various utilities in Wisconsin and other States, to promote and finance railroads, gas, steam, hydroelectric light, power and ice plants. The offices of the company are located in the First National Bank Building, Milwaukee, Wis. W. N. Albertson is president of the company.

Trade Publications

Wiring Devices.—Catalog 24, descriptive of handy electric wiring devices, is being distributed by Pass & Seymour of Solvay, N. Y.

Line Supplies.—Matthews Catalogette, effective Jan. 8, 1917, is now being distributed by W. N. Matthews & Brother, Inc., of St. Louis.

Pickling Machine.—The Mesta Machine Company of Pittsburgh, Pa., has issued its bulletin M, descriptive of its improved pickling machines.

Warming Pad.—The Scientific Products Company, Steubenville, Ohio, has prepared an illustrated folder descriptive of its safety electric warming pad.

Instruments.—The Esterline Company of Indianapolis, Ind., has prepared catalog No. 369 descriptive of Model EB Esterline graphic efficiency instruments.

Water Heaters.—Induction electric water heaters are well described and illustrated in a folder issued by the Coin Machine Manufacturing Company of Portland, Ore.

Reflectors.—*Eye Comfort* for January is now being distributed by the National XX-Ray Reector Company of Chicago and New York. It contains information on comfortable lighting for clubs, lighting the average show window and two January advertisements.

Supplies.—The Cumberland Electric Manufacturing Company of Clarksville, Tenn., has prepared a bulletin descriptive of its low-voltage transformers and electrical specialties.

Mercury Vapor Lamps.—The Cooper-Hewitt Electric Company of Hoboken, N. J., has prepared Bulletin No. 67, descriptive of its P, L, H and K lamps for direct-current indoor lighting.

Sight Box.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., is distributing bulletin No. 631 descriptive of the Leeds & Northrup Lummer-Brodhun photometer sight box.

Lamp Hangers.—Automatic safety disconnecting hangers are illustrated and described in an eight-page bulletin recently published by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio.

Hangers and Pillow Blocks.—The S. K. F. Ball Bearing Company of Hartford, Conn., has issued a well-prepared and illustrated bulletin descriptive of its self-aligning ball-bearing hangers and pillow blocks.

Fans.—"Marelli Fans" is the title of a catalog prepared by H. Boker & Company, Inc., 101 Duane Street, New York City. This company distributes Ercole Marelli & Company of Milan, Italy, products in this country.

Wiring Supplies.—M. B. Austin & Company of Chicago are distributing a set of new loose-leaf bulletins to supplement many now in service. These bulletins are descriptive of this company's wiring devices and fittings.

Dish Washer.—The Walker Brothers Company of Syracuse, N. Y., has issued an illustrated book entitled "Washing Your Dishes," descriptive of its electric dish washer. This book is well illustrated and carefully prepared.

Pipes.—Catalog No. 14, descriptive of Redwood-Douglas fir pipe, has been prepared by the National Tank & Pipe Company of Portland, Ore. This catalog has been carefully prepared and is well illustrated in colors.

Transformer Switches.—The K-P-F Electric Company, 37 Stevenson Street, San Francisco, Cal., has issued a bulletin describing in detail its complete line of K-P-F pole-top fused transformer switches for voltages from 2200 to 33,000.

Air Washers.—Spraco equipment for washing and cooling air, especially applicable for steam turbine generators and other electrical machinery, is carefully described and well illustrated in bulletin No. 250 recently issued by the Spray Engineering Company, 93 Federal Street, Boston, Mass.

Batteries.—The Electric Storage Battery Company of Philadelphia, Pa., has issued bulletin No. 162 entitled "The Progress Made in Our New Buildings Since June, 1916." This company has also prepared bulletin No. 161 descriptive of its chloride accumulator for railway car lighting.

Hardware and Supplies.—"Fierro En Paz" ("Iron in Peace") is the title of a very carefully prepared and illustrated book that has been issued by the Dunham, Carrigan & Hayden Company of San Francisco, Cal. The book contains a brief résumé of this company's history intertwined with the history of California and particularly of San Francisco, and commemorates the sixty-seven years of progress in the business of this company.

Arc Lamps and Lighting Systems.—Under the title of "Arc Lamps and Lighting Systems" the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has just issued a catalog that should interest all connected in any way with the lighting industry. All apparatus necessary for the operation of the various street-lighting systems in use are listed, including constant-current regulators and controlling panels and fixtures for Mazda C lamps, in addition to the regular line of flame carbon and metallic flame arc lamps. Diagrams are also included of the various types of street-lighting systems which should be of great use to prospective purchasers. A complete comparison of the different systems, pointing out their particular value in the various places in which they are used, is given. Luxsolite fixtures with Holophane refractors are listed, together with a complete line of outdoor fixtures, ornamental poles and pole accessories.

New England

PORTLAND, ME.—The Chamber of Commerce is considering the question of the organization of an Industrial Development Association to acquire ownership of a suitable tract of land and the erection of power building thereon in which space will be leased to manufacturers.

MONTPELIER, VT.—The Central Power Corporation of Vermont has entered into a contract with New York parties to supply electricity for the purpose of developing the asbestos fields at Lowell, Vt. Energy will be supplied from the company's plant at Stevens Mills. Charles H. Thompson of Montpelier is interested in the power corporation.

SHELDON SPRINGS, VT.—Work has begun on the erection of an electric transmission line from Sheldon Springs to Sheldon. Electricity to operate the local system will be supplied by the Missisquoi Pulp & Paper Company of Sheldon Springs.

BROCKTON, MASS.—The installation of an electric-lighting plant in the Young Men's Christian Association Building is under consideration. M. A. Davis, Eldon B. Keith and E. W. Thomas have been appointed to investigate the feasibility of putting in such a plant.

TAUNTON, MASS.—Extension of the municipal electric-light and power system to Wade's Corners is under consideration. The cost is estimated to $2,800.

PROVIDENCE, R. I.—Preliminary arrangements have been made for organizing the Bakerville lighting district.

BRIDGEPORT, CONN.—The Board of Aldermen has voted to recommend the extension of the ornamental lighting system on State Street from the present terminus at the City Hall to Courtland Street, which would require 24 lamps. The installation of ornamental lamps on East Main Street is also under consideration.

EAST HAMPTON, CONN.—The East Haddam Electric Light Company has petitioned the State Legislature for permission to change its name to the Central Connecticut Power & Lighting Company.

PLAINFIELD, CONN.—Orders have been placed by the Danielson & Plainfield Gas & Electric Company for a 1500-kw. Allis-Chalmers steam turbine and additional boilers. J. H. Burdick is superintendent.

Middle Atlantic

BINGHAMTON, N. Y.—The electric transmission line which will connect the new plant and substation of the Binghamton Light, Heat & Power Company is now being staked out. The proposed line will be about 5 miles long and will have two independent circuits. The greater part of the material has been purchased.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York City, until Feb. 5, for installing electric-light equipment in Public School 116, Knickerbocker Avenue, Ralph and Grove Streets, borough of Brooklyn. Blank forms, plans, etc., may be obtained at the above office, and also at branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—The Public Service Commission has authorized the Salmon River Power Company to issue $216,000 in bonds, at not less than 87. The proceeds to be held in treasury pending an investigation by the commission into their use, which is stated to be the acquisition of the Pulaski Electric Light Company and certain new construction.

EAGLE BRIDGE, N. Y.—The installation of an electric-lighting system in Eagle Bridge is under consideration. It is proposed to secure energy from Greenwich, via Cambridge and down the old turnpike.

FREDONIA, N. Y.—The Public Service Commission has authorized the Niagara & Erie Power Company of Fredonia to exercise a franchise for an electric plant and distribution lines in the towns of Hanover and Stockholm.

GAROGA, N. Y.—Plans are being prepared by Morrell Vrooman, 10 North Main Street, Gloversville, for a 2000-hp. hydroelectric development on the Garoga Creek at Garoga. Work on the proposed project will begin in the spring.

LONG BEACH, N. Y.—The Long Beach Power Company has applied to the Public Service Commission for permission to erect electric transmission lines on the property of the Estates of Long Beach and of the Lido Corporation.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Feb. 2 for furnishing 1250 fire alarm boxes of non-interference succession type. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Feb. 2 for furnishing and installing subsidiary pipes and fire-alarm posts south of Fourteenth Street in the borough of Manhattan. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2351, Municipal Building, New York City, until Feb. 2, as follows: (1) For furnishing 15 automobiles of the two-passenger type, with a flare board body in rear covered seat; (2) for furnishing ten one-ton motor trucks with bodies and other appurtenances complete. Blank forms and further information may be obtained at the above office.

PORT HENRY, N. Y.—Bids will be received at the office of the clerk of the Board of Education of Port Henry, N. Y., until Feb. 14, for construction of high school. Separate bids to be submitted on heating, electrical work and plumbing. Plans and specifications may be obtained at the office of the Board of Education, Port Henry, and at the office of Tooker & Marsh, architects, 101 Park Avenue, New York City. R. A. Hall is clerk of board.

SAG HARBOR, N. Y.—The Long Island Lighting Company of New York City has petitioned the Public Service Commission for permission to purchase the property and holdings of the Sag Harbor (N. Y.) Electric Light & Power Company; also to consolidate the company with the Long Island Company. The company also asks for permission to issue $25,000 in capital stock and $4,000 in bonds.

SOUTHAMPTON, N. Y.—The Long Island Lighting Company of New York, N. Y., has applied to the Public Service Commission for approval of the purchase of the property of the Suffolk Light, Heat & Power Company of Southampton, and for permission to issue $150,000 in capital stock and $225,000 in bonds. The company also has asked for authority to take over the property of the North Shore Electric Light & Power Company and to issue $75,000 in capital stock and $270,000 in bonds.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York City, until Feb. 14 for construction, including heating, plumbing and drainage and electric work for cottages E, F, G and H at Letchworth Village, Thiells. Drawings and specifications may be consulted at Letchworth Village; at the office of F. B. Kirkbride, secretary, 7 Wall Street, New York City; at the New York office of the Department of Architecture 1224 Woolworth Building; also at the Department of Architecture, Capitol, Albany, where drawings and specifications may be obtained. Lewis F. Pilcher is state architect.

TOMPKINSVILLE, N. Y.—The erection of a new electric transmission circuit, 6000 volts, on both sides of Staten Island, to improve and increase its electrical service, is reported to be under consideration by the Richmond Light & Railroad Company of New Brighton.

ALLENTOWN, PA.—The extension of the ornamental street-lighting system into other sections of the city is under consideration by the city planning commission. Col. H. C. Trexler is at the head of the commission.

DOYLESTOWN, PA.—Local residents have filed a petition with the Public Service Commission asking for improvement in the service now furnished by the Pennsylvania & New Jersey Power & Light Company; also for the operation of the local power plant of the company, which has practically been abandoned.

DU BOIS, PA.—The power house of the Buffalo & Susquehanna Coal Company in Du Bois was wrecked by an explosion on Jan. 17, causing a loss of about $50,000. All the pumps were destroyed.

FARRELL, PA.—The American Sheet & Tin Plate Company is contemplating the construction of a large electric power and boiler house in Farrell to supply power to both the tin plate and sheet mills.

FREELAND, PA.—The Freeland Water Company is considering discarding steam power for operating the three pumping stations and utilizing electricity, to be supplied by Harward Electric Company of Hazleton.

LEWISTOWN, PA.—Plans are being prepared for the construction of a new building, 100 ft. by 150 ft., 12 stories high, to cost about $85,000, for the Young Men's Christian Association. The cost of the equipment is estimated at $10,000, and will include boilers, pumps, filters, electric wiring, electric motors, sweepers, etc. Bids for the proposed work will be received about March 1. J. B. Kamma, York, Pa., is architect.

NEWVILLE, PA.—The Borough Council is considering the establishment of a municipal electric-light plant to supply electricity in Newville and surrounding territory.

NORRISTOWN, PA.—The Counties Gas & Electric Company has acquired property on the Schuylkill River at Conshohocken, to be used in connection with the erection of a new plant. The proposed plant, it is said, will be equipped for an initial generating capacity of 1000 hp.

PHILADELPHIA, PA.—Steps have been taken by the South Sixtieth Street Improvement Association to have the gasoline street lamps on Sixty-first and Sixty-second Streets, between Cedar and Billings Avenues replaced with electric arc lamps.

PHILADELPHIA, PA.—The Public Service Commission has approved the application of the Pennsylvania Heat, Light & Power Company and thirteen other companies to transfer their properties to the Philadelphia Electric Company, all of these comanies being located and doing business in Philadelphia.

PITTSBURGH, PA.—The City Council is considering improvements to the street-lighting system in connection with the new street-lighting contract. The present contract will expire Feb. 1, 1917. It is proposed to replace the arc lamps now in use with nitrogen filled lamps. The Duquesne Light Company furnishes the street-lighting service.

TOWER CITY, PA.—The Gratz Electrical Company, recently organized, is contemplating the installation of a power system to supply electricity in the western section of Schuylkill County.

TULLYTOWN, PA.—The Borough Council is considering the installation of an electric-lighting system to supply electricity for lighting the municipal buildings and residences in the borough. The plans also provide for a street-lighting system.

WILLIAMSPORT, PA.—The electric department of the Sweet Steel Company of Newberry, with repair shop and pattern shop, was destroyed by fire, causing a loss of about $25,000.

DOVER, N. J.—The Morris County Traction Company has closed down its plants at East Dover and Chatham and now secures energy from a substation erected at the foot of Mine Hill, which is operated by the New Jersey Power & Light Company. The line will be extended from this point to serve Kenvil and Sucasunna.

JAMESBURG, N. J.—A proposal has been presented to the Borough Council by Louis H. Saab for the installation of an electric plant and distribution system in Jamesburg. Application for a franchise has been made in the name of the Louis H. Saab Engineering Company.

PERTH AMBOY, N. J.—The Board of Aldermen has authorized the fire committee to purchase an electric testing outfit, at a cost of about $300.

PERTH AMBOY, N. J.—Property owners and merchants on lower Smith Street, between High and State Streets, are planning for the installation of a street-lighting system, using high candlepower lamps. The Public Service Electric Company, it is understood, is interested in the proposed improvement.

SEASIDE PARK, N. J.—Bids will be received by the borough of Seaside Park, N. J., until Feb. 3 (extension of date) for completing the installation of a new 125-hp. boiler, a 250-hp. heater, a 75-kw. generator, etc., at the municipal electric-light and water plant. Aaron Wilbert is borough clerk.

WASHINGTON, N. J.—Bids will be received by the Borough Council until Feb. 19 for lighting the streets and public buildings, either by gas or electricity for a period of five years. Jacob H. Hahn is borough clerk.

MARTINSBURG, W. VA.—The Potomac Light & Power Company, which recently took over the property of the Martinsburg Power Company, is planning to erect an electric transmission system from the high-tension transmission lines of the Hagers-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

town & Frederick Railway Company at Williamsport, Md., to connect with its system at Martinsburg, 7 miles distant, so as to secure auxiliary power from the railway company's power plant at Security, Md.

HOPEWELL, VA.—E. I. Du Pont de Nemours & Company of Wilmington, Del., it is reported, is planning to establish a plant to manufacture nitrogen. Orders, it is understood, have been placed for an electric generator to develop 25,000 hp.

NORTON, VA.—Plans have been completed by the Old Dominion Power Company, recently incorporated with a capital stock of $500,000, whereby it will take over the properties of the Norton (Va.) Light & Power Company, the Coeburn (Va.) Light & Power Company, the Glamorgan (Va.) Light & Power Company, the Norton (Va.) Water Power Company, and the New York Mining & Manufacturing Company, and consolidate them. Beginning Feb. 1 they will be operated under the name of the Old Dominion Power Company. D. Terpstra of Dorchester, Va., is president and general manager of the Old Dominion company.

ROANOKE, VA.—Arrangements are being made by the Roanoke Railway & Electric Company for the installation of a large number of new nitrogen-filled incandescent street lamps to replace the old-style carbon arc lamps.

North Central

ANN ARBOR, MICH.—The Detroit Edison Company, 18 Washington Boulevard, Detroit, it is reported, will soon award contract for construction of a hydroelectric plant on the Huron River, to cost about $140,000.

DETROIT, MICH.—Extensive improvements are contemplated by the Detroit United Railway Company at its power station B at Atwater and Riopelle Streets, work on which will be started early in the spring. The cost of the proposed work is estimated at $150,000, and will include a smokestack, 250 ft. high, with 14½ ft. diameter at the top. Eight 250-hp. boilers will be removed and six 600-hp. boilers will be erected in their place. The main object of the work is the elimination of smoke.

PONTIAC, MICH.—The Oakland Motor Car Company is building a large addition to its factory in Pontiac, which includes an engine plant, machine shop and power plant.

AKRON, OHIO.—The State Utilities Commission has granted the Northern Ohio Traction & Light Company permission to issue $1,000,000 in capital stock. The company contemplates extensive improvements and extensions to its system.

AKRON, OHIO.—The Ravenna-Warren division of the Cleveland, Alliance & Mahoning Railroad Company of Alliance, it is reported, has been sold to the Northern Ohio Traction & Light Company of Akron. The latter company, it is said, will extend the railway from Warren to Youngstown.

AKRON, OHIO.—Bids will be received by the director of public service of Akron, Ohio, until Feb. 14 for furnishing and erecting two water tube boilers of 300 hp. each, to be installed in the Cuyahoga River pumping station near Kent. Copies of plans and specifications, etc., may be obtained from the engineering department, Waterworks office, 102 East Mill Street, Akron, upon deposit of $5, or may be seen at the office of the director of public service.

CHATTANOOGA, OHIO.—Plans are being considered to install an electric-light plant in Chattanooga to supply electricity in the town and neighboring farms with electricity. Post office address Chattanooga, R. F. D. from Rockford.

CINCINNATI, OHIO.—The Cincinnati, New Orleans & Texas Pacific Railway Company, it is reported, is considering plans for equipping its railroad between Cincinnati and Chattanooga for electrical operation. The proposed project includes the construction of a large hydroelectric power plant.

COLUMBUS, OHIO.—The City Council has authorized bids for the construction of the foundations for the new boilers, generators and other equipment in connection with the proposed extensions to the municipal electric-light plant. Herman Gamper is engineer in charge of the work.

CONNEAUT, OHIO.—The Ohio Hydro-Electric Company, recently incorporated with a capital stock of $1,100,000, contemplates the construction of hydroelectric power plants on Conneaut and Ashtabula Rivers, near Conneaut. It is proposed to build the dams and hydroelectric stations about 5 miles southwest of this city. Options have been taken on farm lands along the banks of both rivers. F. R. Garver is interested.

HOLGATE, OHIO.—The village of Holgate has granted the Northwestern Ohio Light Company of Van Wert a franchise to furnish electric service here. The village has operated a municipal electric plant for 15 years.

SANDUSKY, OHIO.—A ten-acre site has been acquired by the Vulcan Forge Company of Sandusky, recently incorporated with a capital stock of $350,000, on which it will soon begin the construction of a plant to make steel forgings. A forge shop, 66 ft. by 200 ft., die room and power plant will be erected. C. H. Lowe is president.

TOLEDO, OHIO.—Plans are being prepared for a system whereby Toledo will be encircled by high-tension transmission lines solely for supplying energy to the local industries. Wires for the new high-tension belt will be strung as soon as the new power house of the Toledo Railways & Light Company is completed.

BUTLER, KY.—The installation of an electric-light plant in Butler is under consideration. C. E. Record is reported interested.

HORSE CAVE, KY.—The property of the Horse Cave Light & Power Company has been purchased by the Kentucky Utilities Company of Louisville for $10,000.

JAMESTOWN, KY.—The installation of an electric-light plant in Jamestown is under consideration. J. E. Russell and others are reported interested.

LEXINGTON, KY.—Plans are under consideration for the construction of two large hydroelectric plants on the line of the Queen & Crescent Route with a view of operating the trains by electricity. It is proposed to build a dam across the Dix River, east of Danville, at a cost of about $1,000,000, and establish a hydroelectric power plant at this point. A movement is also on foot to develop the water power of Cumberland Falls and utilize the power to generate electricity. The officials of the Queen & Crescent Route, it is said, contemplate operating all trains between Cincinnati, Ohio, and Chattanooga, Tenn., a distance of 300 miles, with electricity. Louis Herrington of Richmond, George A. McRoberts of Danville and others are reported interested in the project.

SALEM, IND.—The Stout Furniture Company contemplates rebuilding its plant. The work will include the erection of a two-story frame mill building, 62 ft. by 480 ft.; also a brick structure, 62 ft. by 200 ft., in which the power plant, kilns, etc., will be housed. The work will be done by the company under the supervision of Guy Shrum.

GALESBURG, ILL.—Plans are being considered by the Board of Local Improvements for the installation of an ornamental lighting system on North Broad Street, Public Square, South Broad and East Tromp Streets and several other streets in the city.

STILLMAN VALLEY, ILL.—The capital stock of the Stillman Valley Electric Company has been increased from $8,000 to $16,000.

WAUKEGAN, ILL.—The Chicago, North Shore & Milwaukee Railroad Company of Highwood has submitted a proposal to the City Council asking for a new franchise in Waukegan. Among the features of the proposed new ordinance are possibilities of the construction of a new power house and car house in Waukegan and the extension of the Washington Street car line.

BARTON, WIS.—The Acme Brick & Sand Company, it is reported, has awarded contract for construction of addition to boiler house to A. Berres. Two 160-hp. boilers will be installed.

EAU CLAIRE, WIS.—Plans are being considered for the erection of a girls' dormitory, laundry and power house at the Sacred Heart Hospital, to cost about $35,000. Foeller & Schober, 123 North Washington Street, Green Bay, are architects.

KIMBERLY, WIS.—The Kimberly-Clark Company of Neenah has awarded contract for construction of power house, 60 ft. by 80 ft., at its paper mill in Kimberly, to cost about $25,000, to C. R. Meyer & Sons Company, 50 State Street, Oshkosh.

SHEBOYGAN, WIS.—The Phoenix Chair Company has engaged Vaughn & Meyer, Majestic Building, Milwaukee, consulting engineers, to prepare plans and take charge of remodeling the entire mechanical equipment of its plant. An item published Dec. 9 stated that the company was contemplating the installation of a 500-kw. generator, a 200-hp. engine, etc.

BADGER, MINN.—The installation of an electric-light plant in Badger is under consideration.

PINE CITY, MINN.—An agreement has been entered into, it is reported, whereby the Eastern Minnesota Power Company of Pine City will purchase the Mora electric light plant. The company contemplates extending its transmission line through Henrietta, Mora and Ogilvie in the spring.

SHELLY, MINN.—The installation of an electric-lighting system in Shelly is under consideration. Will probably grant a franchise.

TOWER, MINN.—The City Council has awarded a contract for an oil-burning engine, generator and switchboard. The new unit will be used as an auxiliary to the present hydroelectric plant.

WABASHA, MINN.—Bids will be received by John W. Murdock, clerk of Board of Education, Wabasha, until Feb. 7, for installing heating, plumbing and electric wiring, in both the new and old school buildings, according to plans and specifications on file in the above office, Builders and Traders Exchange, Minneapolis and St. Paul; copies may be obtained from Chandler & Park, architects, Racine, Wis., by remitting $3.

FESTUS, MO.—The municipal electric-light plant is reported to have been sold to the Missouri Electric Company. Improvements are contemplated by the new company, which, it is understood, will extend its transmission lines to some of the smaller towns in the county. A 24-hr. service will also be established.

KANSAS CITY, MO.—The Public Service Commission has granted the Kansas City Electric Light Company permission to increase its capital stock to $4,979,000.

SPRINGFIELD, MO.—Plans are being prepared for the erection of a factory building at Comer, Booneville and Pine Streets for the D. M. Oberman Manufacturing Company, Water and Booneville Streets. The work will include the erection of a 60 ft. by 120 ft., 4 stories high, building to cost about $60,000. The equipment will cost about $40,000 and will include steam heating plant, electric wiring, electric generator, electric elevator, automatic sprinkler, etc. Bids, it is understood, will be awarded the latter part of this month. J. L. Heckenlively, Woodruff Building, is architect.

SWEET SPRINGS, MO.—The installation of another Snow oil engine and an alterating-current generator in the municipal electric-light plant is under consideration.

WARRENSBURG, MO.—The installation of a municipal electric-light plant in Warrensburg is under consideration.

MARMARTH, N. D.—W. R. McKenzie, owner of the local electric-light plant, has submitted a proposition to the City Council for the purchase of the plant.

OMAHA, NEB.—The Union Pacific Railroad Company, it is reported, is contemplating the installation of a power house in Omaha, to cost about $462,000. R. L. Huntley of Omaha is chief engineer.

OMAHA, NEB.—Bids will be received by R. B. Howell, general manager of the Metropolitan Water District, Omaha, until Feb. 7 for a complete pumping unit (30,000,000 gal. capacity per day) for the Florence station.

ARKANSAS CITY, KAN.—The contract for erection of electric system for the Milliken Refinery in Arkansas City has been awarded to the Electric Supply Company, 23 East Fourth Street, Tulsa, at $4,000. The work will include the installation of motors, generators, erection of pole line, wiring, etc.

ELK CITY, KAN.—The installation of an electric-light plant in Elk City is under consideration. W. W. McDaniels of Terlton, Okla, is reported interested in the project.

JETMORE, KAN.—The installation of a new engine in the municipal electric-light and water plant is under consideration.

McCRACKEN, KAN.—At an election held recently the proposal to issue $30,000 in bonds for the installation of an electric-light plant and waterworks system was carried. W. B. Rollins & Company, 209 Railway Exchange Building, Kansas City, Mo., are engineers.

SILVER LAKE, KAN.—The City Council is considering plans for completing the municipal electric-light plant. The generator for the plant was purchased last fall.

WICHITA, KAN.—Bids will be received at the office of the secretary of the board of education, Wichita, until Feb. 3 for the construction of an 18-room intermediate high school building. Bids for heating and ventilating system, plumbing and electric wiring will be received at the same time. Plans and specifications may be obtained at the office of Lorentz Schmidt, architect, Wichita, upon deposit of $25.

Southern States

GREENVILLE, N. C.—The Council has engaged Gilbert White of Charlotte, engineer, to prepare plans for proposed improvements to the municipal electric-light plant and waterworks system. The proposal to issue $52,000 in bonds will be submitted to the voters.

GREENVILLE, S. C.—The Greenville-Carolina Power Company, which erected and controlled the Saluda dam and power plants, near Greenville, it is reported, will be liquidated at once and the properties taken over by the Southern Public Utilities Company of Charlotte, N. C.

ATLANTA, GA.—R. C. Turner, superintendent of electrical affairs, in his annual report, advocates the installation of an additional 15,000,000-gal. pump with 1000 hp. at the river pumping station and waterworks and the installation of a generator at the crematory plant to generate electricity to operate the two pumps. He also recommends the passing of a city ordinance calling for the electrification of all steam railways within the city limits.

AUGUSTA, GA.—The Augusta-Aiken Railway & Electric Company will erect an electric transmission line from Augusta to Sandersville and Tennille, provided sufficient business is guaranteed.

MACON, GA.—Plans are being considered for replacing the five-lamp cluster ornamental lighting system with new standards carrying a single lamp.

NORMAN PARK, GA.—Plans are being considered for rebuilding the municipal electric-light plant and water works system.

TENNILLE, GA.—The citizens have voted to authorize the Mayor and Council to contract for the installation of an electric-lighting system. The city has recently voted to issue bonds for waterworks system and sewers.

HOMESTEAD, FLA.—Bids will be received by the Town Council of Homestead at the office of the town clerk until Feb. 5 for construction of a municipal electric-light plant. W. B. Caves is town lerk.

KNOXVILLE, TENN.—The Cumberland Telephone & Telegraph Company contemplates the erection of a toll line between Knoxville and Bristol (117 miles) to cost about $30,000; also rebuilding the toll line from Knoxville to Dandridge, and the section from Knoxville to Sevierville, to cost approximately $5,000.

LANETT, ALA.—The City Council is considering taking over the local electric-lighting system, owned by the Lanett Cotton Mills.

HEBER SPRINGS, ARK.—The Arkansas Public Utilities Company, recently incorporated, has purchased the property of the Heber Springs Light Comany. The plant is being enlarged preparatory to establishing a 24-hour service. R. R. Amos of Little Rock is president of the new company.

ROGERS, ARK.—A proposal to install and operate an electric-light plant in Rogers, to cost about $100,000, has been submitted to the City Council by Edgar Masoner of Bentonville and W. A. Wilson of Springdale.

EDGERLY, LA.—A company has recently been organized to establish an electric-light and power plant in Edgerly. Equipment for the plant, it is understood, has been purchased. Lee Alford, F. P. Hayes, and W. D. Parker are reported interested in the company.

MONROE, LA.—The proposal to levy a tax to provide funds for rebuilding the municipal electric-light plant, construction of water mains and filtering plant, sewer system, paving, etc., will be submitted to the voters.

ADA, OKLA.—The Oklahoma Light & Power Company, controlled by Mainland Brothers of Oshkosh, Wis., is contemplating the construction of a hydroelectric plant on the Canadian River, 4½ miles north of Ada, at a cost of $3,000,000. Electricity developed at the plant will be transmitted to Ada, Shawnee, Oklahoma City, Guthrie, El Reno, Pauls Valley, Coatgate, McAlester and other cities.

HASKELL, OKLA.—At an election held recently the proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant was carried.

MIAMI, OKLA.—The installation of a 250-kw. generator and engine in the municipal electric-light and water plant is under consideration.

NEW WILSON, OKLA.—At an election held recently the proposal to issue $10,000 in bonds for extensions to the water and light system was carried.

OSAGE, OKLA.—The City Council has made arrangements with the Oklahoma Utilities Company for furnishing electricity for lamps and motors in Osage. A contract has also been awarded for street lighting.

CARRIZO SPRINGS, TEX.—The local electric-light plant has been purchased by W. A. Cunningham of Bowie. New equipment is being installed in the plant.

CUERO, TEX.—The Texas Southern Electric Company, which operates electric light and power systems in Cuero, Victoria, Beeville, Corpus Christi, Yorktown and other towns in South Texas, has changed its name to the Texas Gas & Electric Company. The company, it is said, is contemplating extending its system during the coming year. R. H. Morris is local superintendent.

DALLAS, TEX.—Plans have been prepared by the Southern Traction Company and the Texas Light & Power Company, both of Dallas, for the construction of a power plant on the Oklahoma side of the Red River north of Denison. The site for the proposed paint has been acquired and the Oklahoma Legislature, it is said, will grant the easement asked.

LUBBOCK, TEX.—The City Council has voted to install a municipal electric-light plant, to be operated in connection with the waterworks system and sewage disposal plant. The cost is estimated at from $30,000 to $40,000.

Pacific States

INDEX, WASH.—an ordinance providing for an issue of $10,000 in bonds for the installation of a municipal electric-light plant is under consideration by the Council.

MONROE, WASH.—The Western Light & Power Company of Washougal has petitioned the City Council for a franchise to supply electricity and water in Monroe. The Council is of the opinion that before granting the franchise it should consider the advisability of installing a municipal plant, and has instructed the ordinance committee of the Council to make investigations regarding the establishment of such a plant.

PORT ANGELES, WASH.—Extensive improvements will be made to the street-lighting system, for which $25,000 in bonds were recently voted. Dell Church, city electrician, will have charge of the work.

SEATTLE, WASH.—The contract for electrical work in connection with the West Seattle High School, West Seattle, has been awarded to the Arrow Electric Company, 1627 Fourth Avenue, Seattle, at $14,965.

ALBANY, ORE.—A petition has recently been presented to the City Council favoring municipal ownership of the light and water systems and asking the Council to take steps to acquire the local plants.

BAKER, ORE.—The Pacific States Timber Investment Company of Baker, it is reported, will build a mill of 150,000 ft daily capacity, at a cost of about $150,000. The plans provide for a central power plant and planing mill. The company has received a contract from the United States Government for 125,000,000 ft. of timber.

BAKER, ORE.—Plans have been completed for the construction of a sawmill for the Oregon Lumber Company in Baker to replace the plant destroyed by fire last September. The plant will have a capacity of 200,000 ft. daily and will cost about $200,000. It will be equipped for electrical operation throughout. An auxiliary electric plant to generate about 500 hp., it is reported, is included in the project. D. C. Eccles of Ogden, Utah, is president.

COFFEE, CAL.—Improvements are contemplated to the Jubilee Mine, which has closed down for the season, including widening the ditch sufficiently to supply power to a 150-hp. electric plant which will be erected in the summer. The compressor and mill and ore cars will be operated by electricity instead of by water.

SUMMERLAND, CAL.—Bids will be received by the Department of Agriculture, Washington, D. C., until Feb. 2 for furnishing one kelp harvester fully equipped with propellers, engines, electric lights and cutter to be delivered at Summerfield, Cal. Blank forms, specifications, etc., may be obtained from the chief clerk of the department.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company, it is reported, contemplates the construction of a concrete dam across the Clearwater River, 375 ft. long and 55 ft. high, at a cost of between $40,000 and $60,000. It is estimated that 10,000 hp. can be developed. T. E. Bayliss is superintendent.

POCATELLO, IDAHO.—The City Council has passed an ordinance authorizing the Mayor and city clerk to enter into a contract with Joseph Burns of Pocatello for the purchase of a water right on the Portneauf River, a power site, a hydroelectric generating plant and transmission system. Under the terms of the proposed contract the city is to take 2000 kw. of electrical energy generated at the plant for a period of ten years. At the expiration of the contract the entire property is to be turned over to the city without further charge. The proposed project involves the installation of a distribution system by the city.

SALT LAKE CITY, UTAH.—Preparations are being made to equip the Salt Air Railroad for electrical operation. The entire property of the Saltair Beach Company has been taken over by the Salt Lake, Garfield & Western Railway Company. D. A. Strauss is engineer of the Salt Lake, Garfield & Western Railway Company.

SALT LAKE CITY, UTAH.—Preparations are being made by the Utah Power & Light Company for rebuilding the Olmstead power plant in Provo Canyon, at a cost of $350,000. The new plant will have an output of 8000 hp. The company is also planning to reconstruct a 25-mile section of its interstate trunk line, in order to transmit the extra load now demanded, in cities south of Salt Lake City, including Eureka, Bingham, Arthur, Helper, Magna, Garfield and other towns. The cost is estimated at about $90,000.

SHELBY, MONT.—The installation of a new electric-light plant in Shelby is under consideration. Equipment for the proposed plant, it is understood, has been purchased. James A. Johnson is interested.

SENORITO, N. M.—The J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y., has been awarded a construction and engineering contract by the Senorito (Mex.) Copper Corporation in the Nanciement district, 90 miles from Albuquerque. The contract includes the installation of a mill and power plant, a 2-mile tramway, necessary mining machinery and equipment of the company's coal mine to provide fuel for the power plant. The Greenawalt Electrolytic method of leaching and electric disposition will be used.

Canada

BALA, ONT.—The Bala Electric Light & Power Company, recently organized with a capital stock of $25,000, proposes to establish an electric plant to supply electricity in the village of Bala and vicinity.

CHATHAM, ONT.—The by-law to extend the hydroelectric system, at a cost of $15,500, has been approved by the ratepayers.

HEPWORTH, ONT.—Plans are being prepared by the Hepworth Light & Power Company for the installation of an electric plant to cost about $12,000. The proposed plant will be located on the Sauble River 2 miles from Hepworth.

IROQUOIS FALLS, ONT.—The Abitibi Pulp & Paper Company, it is reported, is contemplating the construction of two dams and a power lant.

KITCHENER, ONT.—The purchase of three 500-kva. transformers to supplement the present equipment of the municipal plant is under consideration by the Light Commissioners.

LONDON, ONT.—Plans are being considered by Public Utilities Commission for additions to the municipal hydroelectric system, to cost about $50,000.

OIL SPRINGS, ONT.—The by-law enabling the Council to install hydroelectric power, at a cost of $10,000, has been approved by the ratepayers.

SCARBOROUGH, ONT.—The township of Scarborough has entered into an agreement with the Hydro-Electric Power Commission of Ontario for energy. Work will soon begin on the erection of the transmission line.

TORONTO, ONT.—The installation of a new lighting system at Ward's Island is under consideration.

TORONTO, ONT.—The Gutta Percha & Rubber Company is contemplating extensions to its power plant.

TORONTO, ONT.—Arrangements have been completed by the Toronto Harbor Commissioners with the Imperial Munitions Board whereby the latter will erect an electric steel and forging plant with an initial capacity of 300 tons per day, on the reclaimed land. The equipment will include ten six-ton, three-phase, 25-cycle Heroult type, electric furnaces. Each furnace will consume about 2000 hp., which will be supplied by the Ontario Hydro-Electric Power Commission.

WATERLOO, ONT.—The by-law to appropriate $6,500 for the purchase of the Snider mill dam has been approved by the ratepayers.

GREENFIELD PARK, QUE.—The installation of an electric-lighting system in Greenfield Park is under consideration. The cost is estimated at $25,000.

1,212,202. Submarine, Subterranean, and Aerial Telephony; Reginald A. Fessenden, Brookline, Mass. App. filed May 12, 1916. Transmission of speech through water as between submarines, etc.

1,212,226. Calculating Machine; Benjamin F. Hutches, Jr., Allendale, N. J. App. filed Sept. 29, 1910. Electricity furnishes the power for setting the registering device.

1,212,229. Apparatus for the Production of Oxygen and Hydrogen Gases; William Jones, New York City, N. Y. App. filed Oct. 16, 1913. Electrolysis of water.

1,212,254. Electric Heater; Albert W. Person and Julius E. Person, Harvard, Neb. App. filed April 8, 1916. Series of heating coils are provided extending in parallel relation.

1,212,260. Thermostat; Henry E. Reeve, New York City, N. Y. App. filed July 26, 1912. For electric alarm circuits.

1,212,276. Connector; Jason C. Stearns, Worcester, Mass. App. filed Aug. 22, 1914. For use in reflecting head lights for automobiles.

1,212,282. Electric Fan and Motor Therefor and for Other Purposes; George S. Tiffany, Summit, N. J. App. filed Oct. 9, 1911. Self starting.

1,212,300. Combined Cut-Out and Lightning-Arrester for Telephone Systems; Harry Spencer Wheaton, Dallas, Iowa. App. filed May 3, 1916. Improved device of this design.

1,212,326. Trolley-Pole-Controlling Device; Edward Albert Colton, Galesburg, Ill. App. filed May 14, 1915. Lower the trolley pole instantly from its operative elevation whenever the trolley wheel becomes disengaged.

1,212,342. Sound-Transmitting System for Moving Pictures; Ely D. George, San Francisco, Cal. App. filed Aug. 2, 1916. Simple and inexpensive apparatus.

1,212,343. Trolley Retriever; Charles E. Gierding, Mansfield, Ohio. App. filed March 23, 1914. Efficient in operation.

1,212,363. Automobile Signaling Device; Laurence J. Killian, Boston, Mass. App. filed Dec. 27, 1915. Give notice to those in the rear.

1,212,375. Illuminating Appliance; Earl C. McKinnie, Chicago, Ill. App. filed June 17, 1916. Used in connection with indirect and semi-indirect systems of lighting.

1,212,426. Process for Producing Homogenous Bodies of Chemically-Pure Tungsten Metal of Any Desired Shape; Otto Voigtlander and Hugo Lohmann, Essen-on-the-Ruhr, Germany. App. filed Dec. 2, 1913. Improvements.

1,212,438. Method of and Means for Determining and Indicating the Depth of Water; Arthur R. Bauder, North Haven, Conn. App. filed Sept. 22, 1911. Principle that the electrical conductivity of a body of water varies in proportion to its depth.

1,212,467. Testing of Insulation; Sydney Evershed, Chiswick, London, England. App. filed March 21, 1914. Improved method and means for ascertaining the condition of insulation.

1,212,476. Dynamo; Victor C. Goodridge, Chicago, Ill. App. filed Sept. 2, 1913. Alternating-current dynamo which will generate a current of high frequency, without requiring dangerously high speed.

1,212,493. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. For facilitating the completing of connections between subscribers.

1,212,492. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. Improvements.

1,212,494. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. Central energy type in which an operator's telephone set is automatically connected to and disconnected from a calling telephone line.

1,212,495. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed July 24, 1916. Automatic ringing for signaling purposes.

1,212,531. Selecting Mechanism; Fred R. McMurry, Westwood, N. J. App. filed Feb. 26, 1915. Wiping contacts between insulated segmental structures and current collecting or distributing devices is obviated.

1,212,541. Therapeutical Appliance; Frederick H. Morse, Boston, Mass. App. filed Jan. 28, 1916. Portion of the apparatus by which contract is made with the body.

Record of Electrical Patents

Notes on United States Patents issued on Jan. 16, 1916.

1,212,544. Dynamo-Electric Machine; Alfons H. Neuland, San Francisco, Cal. App. filed Dec. 26, 1914. Successive north and south poles which follow each other in the same plane.

1,212,547. Automatic Insulator; Rufus A. Parent, South Tacoma, Wash. App. filed May 23, 1916. Plurality of blocks.

1,212,554. Electrical Control Mechanism; Charles Prache, Paris, France. App. filed Aug. 19, 1913. Remote control.

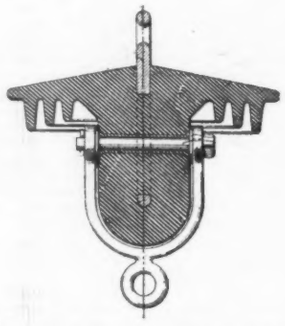
1,212,555. Magnetic Chuck; George G. Pragst, Providence, R. I. App. filed Nov. 9, 1914. Rotary.

1,212,567. Electric Switch; Daniel Schneider, Spokane, Wash. App. filed April 1, 1916. In connection with radiators.

1,212,603. Fuse; Howard H. Baker, Buffalo, N. Y. App. filed Dec. 7, 1916. Renewable fuse strip.

1,212,610. Electrode; Charles W. Dake, Chicago, Ill. App. filed Jan. 31, 1914. For arc lighting.

1,212,632. Combined Switch and Lock Device; Theodore A. Hammond and William P. Hammond, Passaic, N. J. App. filed Oct. 9, 1906. For use in the ignition circuit of explosion engines.



No. 1,212,703. Disk-Type Chain Insulator.

1,212,673. Insulator Supporting Bracket; Charles L. Peirce, Jr., Pittsburgh, Pa. App. filed April 6, 1916. For use on cross-arms.

1,212,694. Fuse; Alf Schaanning and Stanley Austen Stigant, Manchester, England. App. filed Dec. 2, 1916. Horn type.

1,212,699. Electrical Connection; Elda G. Smith, Syracuse, N. Y. App. filed Jan. 8, 1914. Used as a plug in conjunction with a terminal box.

1,212,703. Disk-Type Chain Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Sept. 21, 1912. Adapted to be arranged in flexible concatenated relation.

1,212,704. Disk Strain-Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Dec. 31, 1912. Disk type.

1,212,705. Telephone-Receiver Casing; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 13, 1913. Comprising a body part for retaining the receiver mechanism.

1,212,706. Disk Strain-Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed April 9, 1913. Flexible in construction.

1,212,707. Detachable Connection for Chain-Links; Louis Steinberger, Brooklyn, N. Y. App, filed April 9, 1913. Detachable member which may be readily manipulated for connecting the units together.

1,212,709. Electric-Horn Control; Benjamin Franklin Stephenson, Edmonton, Alberta ,Canada. App. filed Oct. 30, 1915. Improved arrangement adapted to be connected to the steering post.

1,212,728. Telephone-Exchange System; Walter P. Albert, Chicago, Ill. App. filed Dec. 16, 1912. Automatic switching mechanism is employed for effecting connections between subscribers.

1,212,733. Telegraph System; John H. Bell, East Orange, N. J. App. filed May 16, 1916. For repeating or relaying telegraphic signals.

1,212,746. Lightning-Arrester; David C. Davis, Swissvale, Pa. App. filed April 29, 1915. Horn-Gap discharge terminals.

1,212,755. Method of Manufacturing Inductance-Coils; William Fondiller, New York, N. Y. App. filed Sept. 12, 1914. Maintain constant the inductances of the line windings during the process of manufacture of the coils.

1,212,763. Device for Locating Concealed Conductors; Frank J. Gregory, New York, N. Y. App. filed Aug. 26, 1915. Causing a special form of current to traverse the concealed pipe or conductor.

1,212,774. Magnetically - Controlled Mercury-Vapor Apparatus and the Like; Julius Jonas, Baden, Switzerland. App. filed Sept. 12, 1914. In a vacuum vessel.

1,212,785. Telephone Attachment; John L. McMillan, Syracuse, N. Y. App. filed May 6, 1914. Sound amplifying attachments.

1,212,804. Method of Flanging the End of a Metal Tube; Thomas E. Murray, New York, N. Y. App. filed Nov. 4, 1916. Improvement.

1,212,809. Telephone-Exchange System; Frank N. Reeves, Newark, N. J., and Alben E. Lundell, New York, N. Y. App. filed Sept. 11, 1915. Controlling systems for automatic or semi-automatic telephone exchanges.

1,212,821. Spring Fastening; John Schade, Jr., Brooklyn, N. Y. App. filed Dec. 23, 1914. For electrical conductors.

1,212,836. Lighting System for Vehicles; George Gordon Stewart, Roseburg, Ore. App. filed July 20, 1915. Automatically closing an electric circuit by the movement of certain parts of the gear shifting mechanism.

1,212,867. Electric-Switch Contact-Holder; Adolf P. Witte, Chicago, Ill. App. filed Feb. 11, 1916. Carbon contact block may easily and quickly be removed from its holder.

1,212,869. Electric Welding-Machine; Harry R. Woodrow, New York, N. Y. App. filed Oct. 23, 1916. Eliminates the operator, and automatically controls the rate of feed travel of the work.

1,212,870. Device for Picking Up or Lifting Pins, Needles, Etc.; William Zolper, Wilmington, Del. App. filed June 15, 1916. Embodying a magnet.

1,212,874. Mechanical Rectifier; Frank Adsit, Chicago, Ill. App. filed Sept. 15, 1913. Free from sparking at all loads.

1,212,907. Battery-Lamp; William R. Clymer, Cleveland, Ohio. App. filed June 5, 1914. Combination of a flashlight with lens adjusting means, and to a resistance rheostat therefor.

1,212,908. Automatic Telephone System; Jerome E. Cooley, Manhattan, Kan. App. filed Jan. 23, 1914. Improved means for giving the calling subscriber a busy signal.

1,212,958. Alarm System; Carl A. Kalnbach, Detroit, Mich. App. filed May 8, 1913. Duplex automatic electric fire-alarm.

1,213,002. Insulator; Frank C. Pierce, Campbird. Col. App. filed May 31, 1916. Body of the insulator is provided with a slot.

1,213,011. Device for Connecting Outside Wires to Buildings; Philip C. Ragotsky, Philadelphia, Pa. App. filed July 6, 1916. Telephone wires.

1,213,019. Sparking Device: Andrew L. Riker, Bridgeport, Conn. App. filed Jan. 19, 1907. For igniting the explosive charge in an internal combustion engine.

1,213,035. Instantaneous Electric-Socket Attachment; Philip Stroup, Cleveland, Ohio. App. filed Nov. 22, 1915. Inherent properties of being readily attached and detached from a socket in a very short interval of time.

1,213,062. Bridge Signal Apparatus; Noah O. Baty, Springfield, Mo. App. filed Feb. 8, 1916. For railroad bridges.

1,213,066. Wireless Automatic Railway Registering System; Clinton L. Bopp, Waterloo, Iowa. App. filed Feb. 24, 1913. Block signaling systems.

1,213,073. Switch; Minus Carr, Maud, Miss. App. filed Jan. 28, 1916. Controller for electrical ignition systems.